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FROM

Dept of Agriculture.

STATE OF NEW YORK—DEPARTMENT OF AGRICULTURE

REPORT OF DIRECTOR

OF

Farmers' Institutes and Normal Institutes

FOR THE YEAR 1907

C. A. WIETING....... ....Commissioner of Agriculture
F. E. DAWLEY........................Director of Institutes

TRANSMITTED TO THE LEGISLATURE JANUARY 15, 1908

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1908

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Report of Bureau of Farmers' Institutes.

Hon. C. A. Wieting, *Commissioner of Agriculture, Albany, N. Y.:*

Dear Sir.— In submitting herewith my report as Director of Farmers' Institutes for the year 1907, together with a list of the meetings which have been held, it gives me great pleasure to be able to report that this has been the most satisfactory year's work which has ever been done in New York institutes, and that the attendance and interest has been greater than ever before. In spite of the fact that certain enemies of the work have done their utmost to injure it and to affect the attendance, more people have come out than in any previous year, and the interest has never been better.

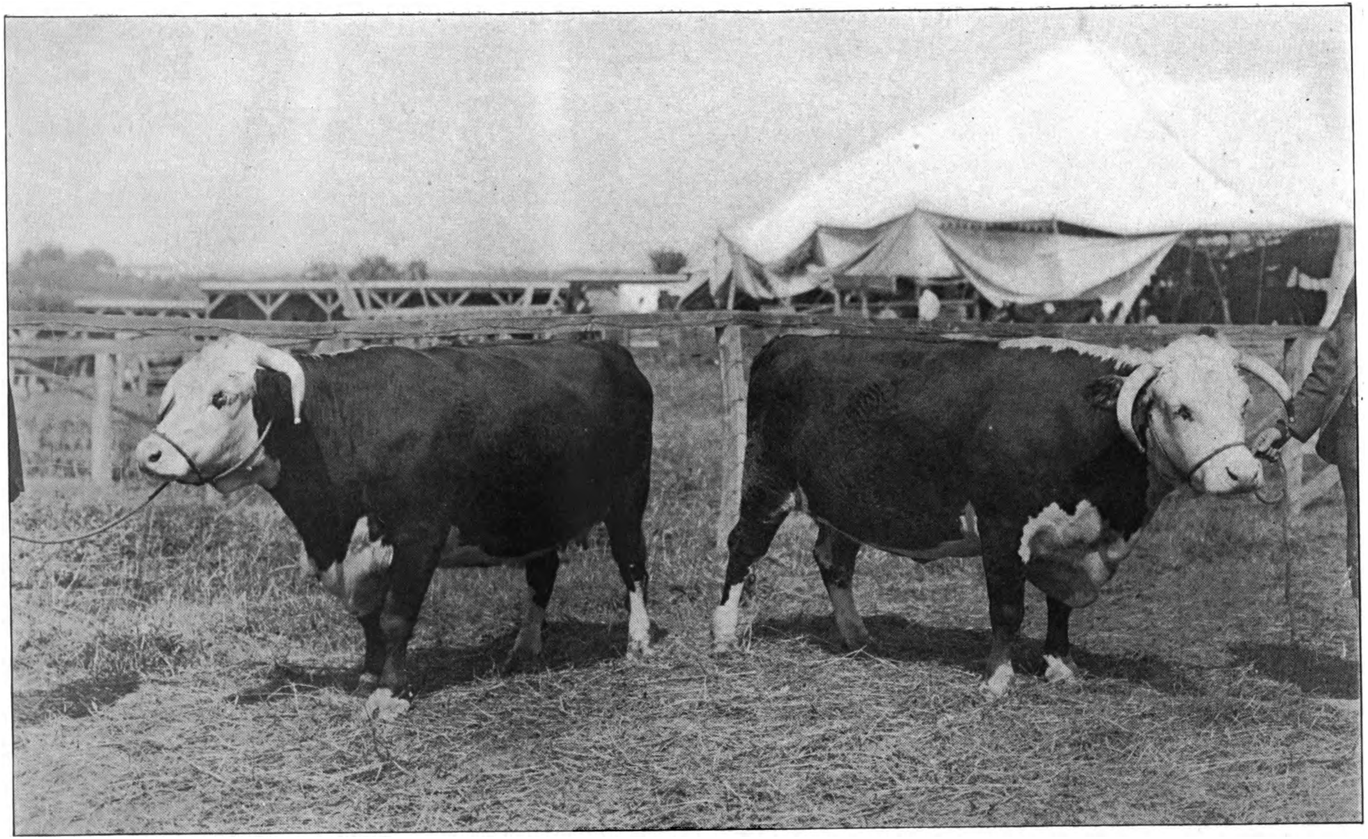
The assistance which we have received from the State Education Department, from the New York Agricultural Experiment Station at Geneva, from the State College of Agriculture at Cornell University, from the Agricultural School at St. Lawrence University, and from the agricultural press, with but one exception, has been very gratifying.

The system of women's institutes which has been inaugurated has proven a very great success, and our lecturers have been able to do for the farmers' wives of the State a work similar to that which the men's meetings have done for the farmers.

I wish to call your attention particularly to this line of farmers' institute endeavor, and to recommend that in the future it be increased to the greatest possible limit. I would urge that an appropriation for the purpose of holding women's institutes be recommended by you. I am confident that much good can be accomplished in this line of endeavor. It is a fact that the women on the farms need information in the most up-to-date methods fully as much, in their line of work, as the men do in theirs, and it is of as much importance to the coming generations that the proper methods of feeding and caring for the children be understood by the mothers as it is that the fathers know how to conduct their farm operations more successfully. Beside, it is almost impossible to secure satisfactory help for the kitchen, which makes it imperative that some relief be afforded the housewife in performing her labor. New appliances are being offered, and these should be tested and reported on by trained observers, as many of these new contrivances do not seem to be giving satisfaction and the women are disinclined to invest in any of them. I have already begun such investigations regarding mechanical dish-washers and laundry machinery, and am testing them.

Holding institutes in New York State and meeting the requirements of our people is a very different proposition than it is in States where the agriculture is less varied. For instance, a study of our year's reports and programs shows that the following subjects were treated in many different phases:

Diseases of domestic animals.
Splints, spavins and ringbones.
Horseshoeing, and the anatomy of the horse's foot and leg.
Care of the horse's foot and teeth.
A rational ration for horses.
Fitting the horse's collar.
Training the colt.
Should New York State farmers raise their own horses?
Care of the farm team.
Care of the brood mare.
Profit in swine.
The bacon hog.
The pig as a market for dairy by-products.
Pasture-fed pork.
Feeding the dairy cow.
Combining rations.
How to figure the nutritive value of cattle foods.
Economy in feeding dairy cows.
Protein crops that can be grown on the farm.
Feeding the land through the animal.
Selection of dairy cows.



TWIN HEREFORD COWS.

Testing cows.
Bovine tuberculosis.
Diseases of the dairy cow.
Diseases of the cow's udder, including parturient apoplexy.
Raising healthy calves.
Raising calves for market.
Stable ventilation.
A sanitary stable.
Constructing and maintaining cement floors.
The advantages of selling milk products instead of the whole milk.
The advantages of co-operative dairying.
Butter-making on the farm.
Making fancy cheeses.
Creamery butter-making.
The relation of the patron to the factoryman.
Care of milk.
The breeding of a herd.
Selection of a dairy sire.
Selection of the dairy cow.
Growing beef in the East.
Advantages of keeping a good cow where but one is owned.
The silo.
Silo construction.
Economy in filling the silo.
Sheep husbandry.
Raising hothouse lambs.
The breeds of sheep and their adaptability to certain conditions.
Diseases of sheep.
Intestinal parasites in sheep.
The sheep barn.
The advantages of keeping a few sheep on a dairy farm.
Preparing animals for exhibition.
Profit in poultry.
Feeding for eggs.
Building poultry-houses.
Feeding for meat.

Care of incubators and brooders.
Line breeding.
Poultry as a side line for farmers.
Poultry as a practical farm crop.
The breeds for business.
Breeding fancy poultry.
Poultry organizations.
Advertising fowls.
The soil.
Tillage.
Farm drainage.
The surroundings of farm buildings, including cess-pools and drains.
Chemistry of the soil.
Easy draft and effective work with plows and cultivators.
Cultivation of cover crops.
An ideal mechanical condition of the soil.
Green manuring.
The advantage of cover crops.
Stable manures and their application.
Care of stable manures.
Commercial fertilizers.
Figuring commercial values of commercial fertilizers.
What elements of plant food does your soil need?
Farm experiments.
Chemicals with stable manures.
Grass seed and grasses.
Permanent pastures.
Clover.
Alfalfa.
Preparing the land for alfalfa.
Alfalfa, the great protein producer.
Curing alfalfa and clover hay.
Alfalfa silage.
Clover silage.
Corn silage.
Canning factory refuse silage.
Profitable oat production.

When to grow wheat.

Buckwheat as a catch crop.

Care of the corn field.

Selection of seed.

Care of seed grain.

Cleaning seed grain.

Grain smuts and how to prevent them.

The timothy hay crop.

Awnless Brome grass and other natural fodder plants.

Kaffir corn.

Growing sugar beets.

Profit in potatoes.

The advantages of level culture.

How to prevent potato blight and rot.

Holding potato bugs in check.

Cabbage as a farm crop.

Cantaloupe as a farm crop.

Market gardening, touching upon all the phases of the work and the various special garden crops.

Growing vegetables under glass.

The production of farm seeds.

Preparing for an orchard.

Laying out and setting an orchard.

Fertilizing orchards.

Cultivation of orchards.

Cover crops for orchards.

Spraying orchards.

Spraying to prevent scab.

Spraying to hold insects in check.

The preparation of spray mixtures.

Effective spraying machinery.

Grapes as a practical farm crop.

Care of the vineyard.

How to prevent sloughing.

Marketing the grape crop.

Co-operation in selling grapes.

Some results in the pollenization of crops.

Small-fruit growing.
The evaporation of fruits.
Fruits for home use.
Growing ginseng.
Tobacco growing in all its different phases.
Growing tobacco under cloth.
Growing teasles.
The farmer's garden.
Feeding the farmer's family.
First aid to the injured.
Cooking for those who are ill.

Some thirty different subjects relating to household economics, including demonstrations in cooking, etc.

What the State is doing for agriculture.
The work of the Department of Agriculture.
What is being done at Cornell University.
What is being done at the State experiment station at Geneva.
The farmer as a citizen.
The farmer's relation to the business world.
Farm bookkeeping.
Success.
The value of humane education.
Child life.
Our common schools.
The most useful implement.
The help question.
Agriculture as a profession.
The farm and the boy.
The chemistry of cattle foods.
The chemistry of milk.
The farm home.
The value of organization.
Window gardening.
Forcing vegetables.
Greenhouse management.
The weed problem.
Plant diseases and their treatment.
Birds and books.

The relation of birds to agriculture.
Insect pests and how to control them.
Gassy and red spot cheese.
Pasteurization.
A talk with children about common plants.
Teaching the children preservation.
The advantages of being born on a farm.

In selecting speakers for the institutes, I have been very careful to put out only those who are honest and true, and who are actually doing, either at the college or station or on their own places, work along the lines on which they speak. This makes it necessary to keep in close touch with the "lecturers," and to try many "new" ones. In holding the work so closely in hand, I have made some enemies which is, I presume, the case of every public official who does his duty by the State.

On the whole, when I think of the ambitions and aspirations of some persons whom I have been obliged in the development of the work to thwart, and the personal interests of a few, which I have been obliged to keep in check so far as the farmers' institutes are concerned, I am surprised that those who feel aggrieved are so few.

Yours respectfully,
F. E. DAWLEY.

JANUARY 1, 1908.

List of Farmers' Institutes held in New York State During 1907.

PLACE.	County.	Date.	
Phœnix	Oswego	Jan.	2–3
Hannibal	Oswego	Jan.	4–5
Central Square	Oswego	Jan.	4–5
Ludlowville	Tompkins	Jan.	7–8
Ira	Cayuga	Jan.	7–8
Pulaski	Oswego	Jan.	7–8
Jacksonville	Tompkins	Jan.	9
Wolcott	Wayne	Jan.	9–10
Hudson	Columbia	Jan.	9–10
Lacona	Oswego	Jan.	9–10
Newfield	Tompkins	Jan.	10
Speedsville	Tompkins	Jan.	11–12
Williamson	Wayne	Jan.	11–12
Claverack	Columbia	Jan.	11–12
Adams	Jefferson	Jan.	11–12
Owego	Tioga	Jan.	11–12
Hilton	Monroe	Jan.	14–15
Pine Plains	Dutchess	Jan.	14–15
South Rutland	Jefferson	Jan.	14
Kendall	Orleans	Jan.	15
Lafargeville	Jefferson	Jan.	15
Union Centre	Broome	Jan.	16–17
Lyndonville	Orleans	Jan.	16
Millerton	Dutchess	Jan.	16–17
Hammond	St. Lawrence	Jan.	16–17
Johnson's Creek	Niagara	Jan.	17
Waverly	Tioga	Jan.	18–19
Clarence Centre	Erie	Jan.	18
Clinton Corners	Dutchess	Jan.	18
Carthage	Jefferson	Jan.	18–19
Pekin	Niagara	Jan.	19
North Clove	Dutchess	Jan.	19
Alpine	Schuyler	Jan.	21–22
Elba	Genesee	Jan.	21–22
Patterson	Putnam	Jan.	21–22
Philadelphia	Jefferson	Jan.	21–22
Darien	Genesee	Jan.	23
Adams Corners	Putnam	Jan.	23–24
Lowville	Lewis	Jan.	23–24

PLACE.	County.	Date.
Rochester (Western New York Horticultural Society)	Monroe	Jan. 23–24
Wyoming	Wyoming	Jan. 24
Bath	Steuben	Jan. 25–26
Perry	Wyoming	Jan. 25–26
Peekskill	Westchester	Jan. 25–26
Canton	St. Lawrence	Jan. 25–26
Newfane	Niagara	Jan. 26
Prattsburg	Steuben	Jan. 28–29
Arcade	Wyoming	Jan. 28–29
Mineola	Nassau	Jan. 28–29
Gouverneur	St. Lawrence	Jan. 28–29
Howard	Steuben	Jan. 30
Castile	Wyoming	Jan. 30
Riverhead	Suffolk	Jan. 30–31
Ogdensburg	St. Lawrence	Jan. 30–31
Canisteo	Steuben	Jan. 31–Feb. 1
Bliss	Wyoming	Jan. 31
New Berlin	Chenango	Jan. 31
Sonyea	Livingston	Feb. 1
Southold	Suffolk	Feb. 1–2
Rathbone	Steuben	Feb. 2
Fort Hill	Genesee	Feb. 2
Potsdam	St. Lawrence	Feb. 1–2
Addison	Steuben	Feb. 4
Albion	Orleans	Feb. 4–5
Bridgehampton	Suffolk	Feb. 4–5
Massena	St. Lawrence	Feb. 4–5
Jasper	Steuben	Feb. 5–6
Huntington	Suffolk	Feb. 5
Holley	Orleans	Feb. 6–7
Unionville	Orange	Feb. 6–7
Winthrop	St. Lawrence	Feb. 6
Troupsburg	Steuben	Feb. 7–8
Lawrenceville	St. Lawrence	Feb. 7
Brockport	Monroe	Feb. 8–9
Monticello	Sullivan	Feb. 8–9
Brushton	Franklin	Feb. 8–9
Alfred	Allegany	Feb. 11–12
Walworth	Wayne	Feb. 11–12
Otisville	Orange	Feb. 11–12
Malone	Franklin	Feb. 11–12
Black Creek	Allegany	Feb. 13
Weedsport	Cayuga	Feb. 13–14
Goshen	Orange	Feb. 13–14
Chateaugay	Franklin	Feb. 13
Portville	Cattaraugus	Feb. 14–15
Ellenburg Depot	Clinton	Feb. 14

PLACE.	County.	Date.	
Machias	Cattaraugus	Feb.	14–15
Seneca Falls	Seneca	Feb.	15–16
Monroe	Orleans	Feb.	15–16
Chazy	Clinton	Feb.	15–16
Salamanca	Cattaraugus	Feb.	18–19
Sherwood	Cayuga	Feb.	18–19
Washingtonville	Orange	Feb.	18–19
Morrisville	Clinton	Feb.	18
Keeseville	Essex	Feb.	19
Falconer	Chautauqua	Feb.	20–21
Elmira	Chemung	Feb.	20–22
Halcottsville	Delaware	Feb.	20–21
Willsboro	Essex	Feb.	20
Westport	Essex	Feb.	21–22
Poughkeepsie (Eastern New York Fruit Growers)	Dutchess	Feb.	21–22
Sinclairville	Chautauqua	Feb.	22–23
Andes	Delaware	Feb.	22–23
Crown Point	Essex	Feb.	23
Gasport	Niagara	Feb.	23
Dewittville	Chautauqua	Feb.	25–26
Cortland	Cortland	Feb.	25–26
Davenport	Delaware	Feb.	25–26
Putnam	Washington	Feb.	25
Argyle	Washington	Feb.	26
Sherman	Chautauqua	Feb.	27–28
Manlius	Onondaga	Feb.	27–28
Schenevus	Otsego	Feb.	27–28
Gansvoort	Saratoga	Feb.	27
Greenfield Centre	Saratoga	Feb.	28
Collins Centre	Erie	Mar.	1–2
Fulton	Oswego	Mar.	1–2
Vischer Ferry	Saratoga	Mar.	1
Brocton (Grape Belt Fruit Growers' Meeting)	Chautauqua	Mar.	1–2
West Sand Lake	Rensselaer	Mar.	2
Springville	Erie	Mar.	4
Ripley	Chautauqua	Mar.	4
East Worcester	Otsego	Mar.	4–5
Hoosick Falls	Rensselaer	Mar.	4–5
Marilla	Erie	Mar.	5
Bowmansville	Erie	Mar.	6–7
Webster	Monroe	Mar.	6
Morris	Otsego	Mar.	6–7
Salem	Washington	Mar.	6
Granville	Washington	Mar.	7
Spencerport	Monroe	Mar.	8
Utica (Farmers' Club)	Oneida	Mar.	8

PLACE.	County.	Date.	
Gilbertsville	Otsego	Mar.	8–9
Chatham	Columbia	Mar.	8
Penn Yan	Yates	Mar.	9
Sandy Hill	Washington	Mar.	9
Kinderhook	Columbia	Mar.	9
Hamilton	Madison	Mar.	11–12
Sandy Hill	Washington	Mar.	11–12
Fairfield	Herkimer	Mar.	11–12
Selkirk	Albany	Mar.	11–12
Otisco	Onondaga	Mar.	12
West Eaton	Madison	Mar.	12
Nunda	Livingston	Mar.	12
Yorktown	Westchester	Mar.	14
Reading Centre	Schuyler	Mar.	20
Watkins	Schuyler	Mar.	21
Red Hook	Dutchess	Mar.	26–27
Ransomville	Niagara	Mar.	30
Kerhonkson	Ulster	Apr.	9
Accord	Ulster	Apr.	10
Kyserike	Ulster	Apr.	11
Cottekill	Ulster	Apr.	12
New York (Hudson Square Library)	New York	Apr.	2
New York (Public Library)	New York	Apr.	3
Mott Haven (New York)	New York	Apr.	5
Salem	Washington	June	27
Avon	Livingston	Nov.	7
Geneseo	Livingston	Nov.	8
Ithaca (Normal)	Tompkins	Nov.	25–27
Geneseo	Livingston	Nov.	29
Speedsville	Tompkins	Dec.	2
Richville	St. Lawrence	Dec.	2–3
Duanesburg	Schenectady	Dec.	2–3
Candor	Tioga	Dec.	3
Lawyersville	Schoharie	Dec.	4
Hermon	St. Lawrence	Dec.	4–5
Nichols	Tioga	Dec.	4–5
Seward	Schoharie	Dec.	5
Owego	Tioga	Dec.	6–7
Lisbon	St. Lawrence	Dec.	6–7
Gallupville	Schoharie	Dec.	6–7
Chemung	Chemung	Dec.	9
Lawrenceville	St. Lawrence	Dec.	9–10
Livingstonville	Schoharie	Dec.	9–10
Malone (State Dairymen's Assn.)	Franklin	Dec.	10–11–12
Dundee	Yates	Dec.	10–11
Preston Hollow	Albany	Dec.	11
Reading Centre	Schuyler	Dec.	12
Oak Hill	Greene	Dec.	12–13

PLACE.	County.	Date.	
Tyrone	Schpyler	Dec.	13
Madrid	St. Lawrence	Dec.	13–14
Chateaugay	Franklin	Dec.	13–14
Wayne	Steuben	Dec.	14
Cornwallville	Greene	Dec.	14
Ellenburg Depot	Clinton	Dec.	14
Bath	Steuben	Dec.	16–17
West Chazy	Clinton	Dec.	16–17
West Shokan	Ulster	Dec.	16–17
Keeseville	Essex	Dec.	17–18
Prattsburg	Steuben	Dec.	17–18
Rochester (State Breeders' Assn.)	Monroe	Dec.	17–18
Andes	Delaware	Dec.	18
Avoca	Steuben	Dec.	18–19
Willsboro	Essex	Dec.	18–19
Halcottsville	Delaware	Dec.	19
Crown Point	Essex	Dec.	19–20
Avon	Livingston	Dec.	20
Bristol Springs	Ontario	Dec.	20–21
Davenport	Delaware	Dec.	20–21
Kortright	Delaware	Dec.	21
Putnam	Washington	Dec.	21
Geneseo	Livingston	Dec.	21
Jay	Essex	Dec.	20–21

SPECIAL BEEKEEPERS' INSTITUTES.

Mt. Morris	Livingston	Dec.	9
Canandaigua	Ontario	Dec.	10–11
Auburn	Cayuga	Dec.	12
Syracuse	Onondaga	Dec.	13
Fulton	Oswego	Dec.	14
Watertown	Jefferson	Dec.	16–17
Amsterdam	Montgomery	Dec.	18–19
Albany	Albany	Dec.	20
Glens Falls	Warren	Dec.	21

SPECIAL POULTRY INSTITUTES.

Ithaca (Cornell University)	Tompkins	Feb.	18–20
Penn Yan	Yates	Mar.	2–3
Corfu	Genesee	Mar.	4–5
Auburn	Cayuga	Mar.	6–7
Ballston Spa	Saratoga	Mar.	9–10
Mineola	Nassau	Mar.	11
Riverhead	Suffolk	Mar.	12

SPECIAL WOMEN'S INSTITUTES.

PLACE.	County.	Date.	
Belleville	Jefferson	Oct.	23–24
Gouverneur	St. Lawrence	Oct.	25–26
Canton	St. Lawrence	Oct.	28–29
Brushton	Franklin	Oct.	30–31
Saranac Lake	Franklin	Nov.	1–2
Westport	Essex	Nov.	4–5
Burnt Hills	Saratoga	Nov.	6–7
Stephentown	Rensselaer	Nov.	8–9
Upper Red Hook	Dutchess	Nov.	11–12
Herkimer	Herkimer	Nov.	13–14
Clinton	Oneida	Nov.	15–16
Hamilton	Madison	Nov.	18–19
Fayetteville	Onondaga	Nov.	20–21
Hannibal	Oswego	Nov.	22–23
Webster	Monroe	Nov.	25–26
Sanborn	Niagara	Dec.	2–3
Chaffee	Erie	Dec.	4–5
Batavia	Genesee	Dec.	6–7
Falconer	Chautauqua	Dec.	9–10
Iroquois	Cattaraugus	Dec.	11–12
Hinsdale	Cattaraugus	Dec.	13–14
West Henrietta	Monroe	Dec.	16–17
Newark	Wayne	Dec.	18–19

LIST OF FARMERS' INSTITUTE LECTURERS.

1907–1908.

NAME.	POST OFFICE ADDRESS.
Dr. L. H. Bailey	Cornell University, Ithaca, N. Y.
Miss Anna Barrows	Boston, Mass.
Mr. J. A. Bizzell	Cornell University, Ithaca, N. Y.
Mr. N. O. Booth	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. C. W. Brodhead	Montrose, Pa.
Mr. H. E. Cook	Denmark, N. Y.
Mr. J. G. Curtis	Box No. 272, Rochester, N. Y.
Prof. George W. Cavanaugh	Cornell University, Ithaca, N. Y.
Prof. John Craig	Cornell University, Ithaca, N. Y.
Mr. Charles M. Day	Geneva, N. Y.
Hon. D. P. Witter	Berkshire, N. Y.
Mr. M. Ray Dawley	Kingston, N. J.
Mr. V. E. Fuller	No. 139 Somers St., Brooklyn, N. Y.
Mr. W. N. Giles	Skaneateles, N. Y.
Hon. Fred E. Gott	Spencerport, N. Y.
Prof. C. K. Graham	Storrs, Conn.

NAME.	POST OFFICE ADDRESS.
Prof. F. H. Hall	New York Agricultural Experiment Station, Geneva, N. Y.
Prof. H. A. Harding	New York Agricultural Experiment Station, Geneva, N. Y.
Prof. U. P. Hedrick	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. C. J. Huson	Penn Yan, N. Y.
Dr. W. H. Jordan	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. John D. Jaquin	Watervliet, N. Y., R. F. D.
Prof. T. L. Lyon	Cornell University, Ithaca, N. Y.
Mr. T. F. McCrew	Washington, D. C.
Mr. E. B. Norris	Sodus, N. Y.
Prof. P. J. Parrott	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. George A. Smith	New York Agricultural Experiment Station, Geneva, N. Y.
Prof. F. C. Stewart	New York Agricultural Experiment Station, Geneva, N. Y.
Prof. O. M. Taylor	New York Agricultural Experiment Station, Geneva, N. Y.
Dr. L. L. Van Slyke	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. W. J. Schoene	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. James Wilson	New York Agricultural Experiment Station, Geneva, N. Y.
Mr. Jared Van Wagenen, Jr	Lawyersville, N. Y.
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Prof. H. J. Wilder	Washington, D. C.
Mr. S. D. Willard	Geneva, N. Y.
Mr. N. V. Witbeck	Ballston Springs, N. Y.
Dr. W. W. Cooke	Washington, D. C.
Mr. Edward P. Mayo	Waterville, Maine.
Mr. T. E. Martin	West Rush, N. Y.
Mr. M. Earl Carr	Washington, D. C.
Prof. Jay A. Bonesteel	Washington, D. C.
Mr. F. N. Godfrey	Olean, N. Y.
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THE FOLLOWING SPEAKERS WERE FURNISHED BY THE EDUCATION DEPARTMENT.

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Prof. E. F. McDonald	Education Department, Albany, N. Y.
Prof. S. J. Preston	Education Department, Albany, N. Y.
Prof. J. M. Thompson	Education Department, Albany, N. Y.
Prof. J. D. Sullivan	Education Department, Albany, N. Y.
Prof. C. A. Shaver	Education Department, Albany, N. Y.
Prof. Sherman Williams	Education Department, Albany, N. Y.
Prof. P. M. Hull	Education Department, Albany, N. Y.

PAPERS, ADDRESSES AND DISCUSSIONS

AT THE

Normal Institute at the College of Agriculture, Cornell University, Ithaca, N. Y., November 25-27, 1907.

Opening Remarks.

By Dr. L. H. Bailey, Dean of the College of Agriculture.

We are glad to have you here again. We have now cut loose from our old quarters in the University buildings, which we formerly occupied, with the single exception that the agricultural chemistry is in Morse Hall. Horticulture now occupies the southern part of the grounds in glass houses which began to be built nineteen years ago. We are hoping after a while to have the glass houses in connection with this series of buildings. The landscape gardening is lodged, in part, in White Hall. With these exceptions, the instructural and experimental work of the College of Agriculture is housed in this series of buildings. These are four in number, three of which are connected by loggias. You are now going in the agronomy building. The lower part of this building is used for farm machinery. The remainder of this building is used for plant industries. On this first floor we have two lecture-rooms, and they are small. The modern college building is not characterized so much by lecture-rooms as by laboratories. This room is the soils lecture-room. We will utilize this room for the meeting of the normal institute until the attendance becomes too large, perhaps holding the evening sessions in the auditorium in the main building. The elementary soils laboratory for teaching soils is on this floor. It will be interesting for you to see what these modern laboratories do, and I shall ask Professor Fippin to show you what he is doing in regard to soils.

Just over this room is a large farm-crops laboratory, and at the north, over the elementary soils laboratory, is the advanced soils laboratory. It is used for experimental or research work and also for some work with the post graduates.

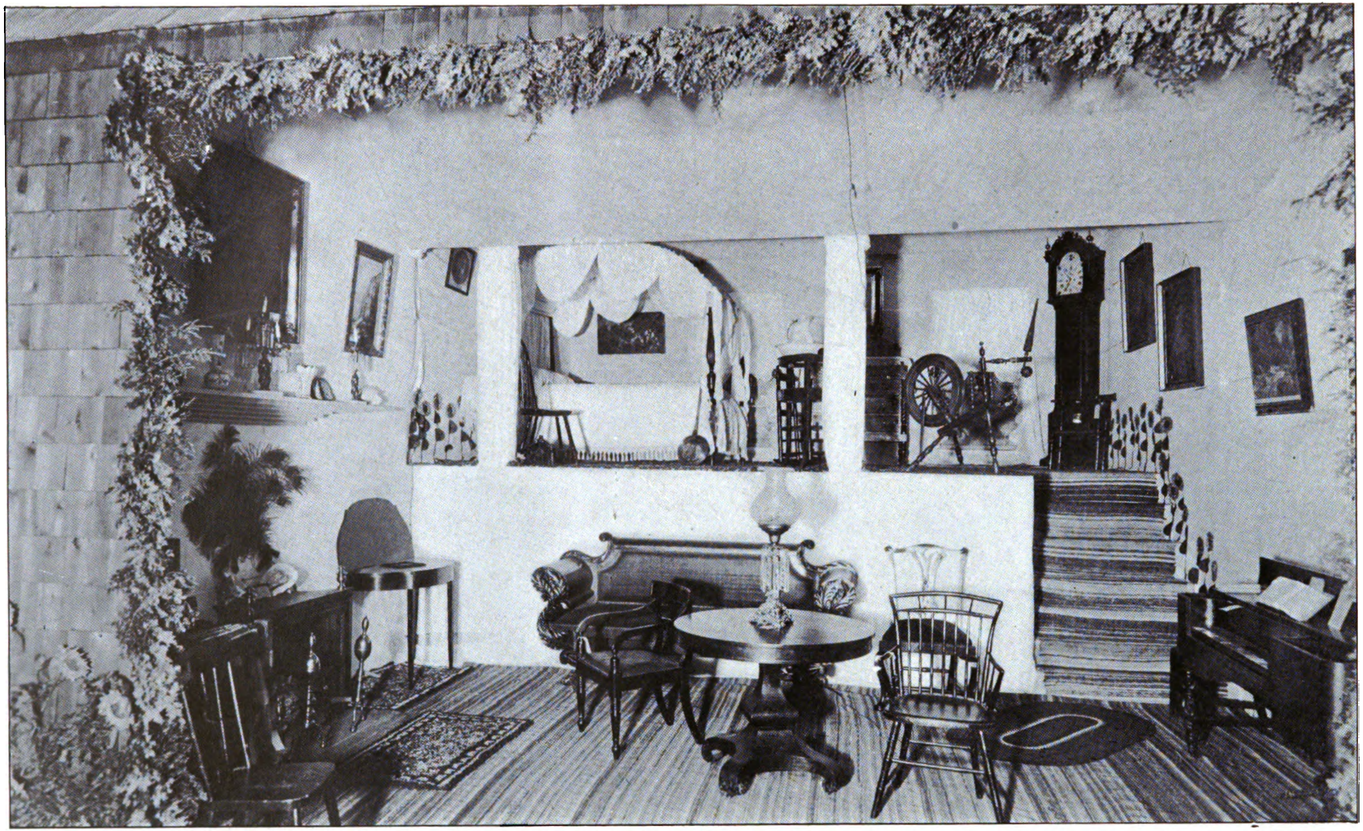
The top floor of this building was planned by Professor Hunt to be used largely for storerooms, and, therefore, was not finished and heated; but, because of the growth of the departments, we are now obliged to utilize the top of the building for other purposes. On this top floor are housed the departments of plant diseases and also Dr. Webber's work with plant breeding. We had hoped to have that floor thoroughly in order at this time, but it has been impossible to complete the work of construction.

The first floor of the main building has the main auditorium, three or four offices, library, the directors' suite and business offices. In the basement of that building is one of the most interesting rooms in the college — the mailing-room — which is not yet thoroughly organized, but I advise you to drop in there. The mailing machines are not in place. We expect all second-class material will be mailed from that room. The files are also kept there. The archives, or those publications that are out of print, are across the hall in storerooms. The main lavatories are on that floor.

The second floor of the main building is devoted to horticulture, with the exception that in the far corner is the women's retiring-room. On this floor is the fruit exhibition by students. This fruit exhibition is still in place, or at least the larger part of it. They have kept is so that the visitors might see it.

The third floor above that is used for entomology, and on the top floor is the weather bureau, and also rooms for home economics, which are not yet in order. On the top floor are rooms for photographic work, and from the roof is the finest outlook from the University. You can see the lake and all the country about.

Then through the loggia is the dairy building on the other end, which is in two main parts, the upright, used for lecture-rooms and laboratory-rooms, and the dairy manufacture, which is divided into three parts, the butter factory, cheese factory, and across this end the market milk department. We put these factories in a wing by themselves so that the noise of the machinery is away from the lecture-rooms and microscopic-rooms. Professor Pearson will explain to you the dairy building which we think is as good as anything else in the country devoted to this purpose. In the basement of the main dairy building are the lavatories and various workrooms, and on the main floor are the offices of the department and the rooms for dairy bacteriological work. On the floor above is a large lecture-room, which is one of the most complete and best in the University. The top floor



Colonial Room at a State Fair.

is not yet utilized, but we have plans for fitting it up. In the rear, but not connected with the other buildings, is the animal husbandry building; there is the large judging pavilion. In fact the whole building, 60 x 90 feet, is planned to be one judging pavilion, but we have temporarily cut off one end of it for offices and classrooms. We hope in time to be able to use it only as a judging-room. At the rear are the poultry-houses and the barn.

This gives you a general idea of the place. You will find the buildings still in disorder in some parts. The furniture is not all in. It takes a long time to secure some of this equipment because it comes from abroad. By March or April we hope to have the equipment all in, and it, together with the buildings, will represent an outlay of about $400,000.

Next week the winter-course opens. There were 246 students last year. I presume we will have an equal number this year. We will have at any rate all that we can conveniently handle.

I ought to say that just at the west from where we sit is another part of the agricultural college, and that is the rural schoolhouse. It is a part of our normal work. The purposes of the schoolhouse are two or three. In the first place, we wanted to illustrate the fact that with a given amount of money, say $1,800 or $2,000, you can build a more attractive schoolhouse than the ordinary. It should have a place for something else beside mere book work, say two rooms occupying the proportion of about two to one in floor space, the larger room for the old time recitation work and the new one for nature study work. Then there is a school garden in connection with it. It was started last year, and while the garden is in good shape now, next year it will be in more perfect condition. We have about twenty students who are fitting themselves to be teachers of nature study and agriculture, and the theory is that the rural schools should be the laboratory for those teachers. The public schools are open to us and more or less practice work is done there with the children. We have not yet organized in this schoolhouse a rural school, but I hope by another year we shall be able to have a rural school there.

I think you ought, before you leave, to take the opportunity of getting in touch with the laboratories and class work and the things that are actually done in a modern agricultural college.

Response.

By F. E. Dawley, Director Farmers' Institutes.

I wish to assure Professor Bailey on the part of the institute workers that we are glad to be here, and to do our work in this College of Agriculture building. When the first normal institute was held many years ago, many of us had in our mind's eye an agricultural building on the campus, perhaps not so elaborate as this, and a few are to-day, for the first time in that building, we feel to a certain extent that this is our college building, that it belongs to the farmers of the State and the institute workers of the State. I believe every man connected with the institute work knows to-day of more than one student enrolled here who received his first impetus for a college education at the farmers' institute, and I am confident that one of the best lines of work we are doing is to encourage young men who are interested in agriculture to take up its study.

I am not going to take the time to say very much in regard to the institute work. Before we are through with the meetings I hope to give you some thoughts which may be of value to you in the coming year. I want you to know that the business of the Director of Farmers' Institutes, to a certain extent, is narrowed down, after the work is planned, pretty nearly to clerical work; that the correspondence is very monotonous and is quite similar. Each man has problems which he thinks never have been brought up, but we find they are the same problems that are being worked out in other localities. The work is monotonous and tedious, but at the same time it has got to be done for each of these local correspondents if the institutes go off as they should in the winter.

The corps of workers is practically the same. Only one of the conductors has dropped out of the work, Mr. Van Alstyne. We all miss him in the work, but we trust that his heart is with us in it. Three or four men are brought in from the outside, men who have not been with us before, but about the same number have been brought in each year from the outside to work with us. I trust that every man who is engaged to work at the institutes during the coming winter believes in the institute movement. I think that is the fundamental principle which the whole work we are doing centers around. If a man does not believe in the institute, it is going to be impossible for him to do very effective work in it. Twenty years ago, when the institute work was new, almost any successful, practical, farmer, who had ability to express his thoughts and who had convictions, made an acceptable institute worker, and to-day, in many sections, and before many audiences, a man of this type furnishes the best of help, but he must be something more than a practical man who has achieved success. His success must have come from agricultural practice carried out along orthodox lines and his opinions must be backed by scientific information.

We have come to a time in the history of the farmers' institute movement in this State when the best work will be done by men and women especially equipped for it, capable of imparting information, who have in their own practice achieved success and who are able to show the evidences of having applied the results of the best agricultural thought and research in their practical every-day farm work. The principal reason why this type of lecturers is demanded is that the farmers of New York State are a reading, thinking people, and the majority of them are much better posted than were the leading men a generation ago. The means for spreading information have increased wonderfully and during the past few years people have been better able to purchase books and papers, the inclination to experiment has gained ground rapidly, and everywhere are men who are trying the new ideas in agriculture. They are reading everything they can obtain along the line of their specialties, and when a speaker who knows his subject addresses them, he finds them receptive and anxious to obtain information. They are continually reading and thinking, and each will bring a more cultured brain and more accurate knowledge of the principles which underlie their specialties than the year before. The farmers' institute lecturer who undertakes to be received graciously must not only be abreast of the times but he must be in advance of them.

I do not mean to say that a knowledge of agriculture will make any man a successful farmers' institute worker. One may have studied all branches of agricultural chemistry, soil physics and be thoroughly posted in many other lines of scientific thought and research and still not be acceptable. The farmers are anxious to meet men who are studying in nature's great school and those who have worked out their problems in the soil with the tree, shrub or plant are the ones who are best equipped to impart knowledge.

In a corps of workers it is of the utmost importance that the work of the speakers be uniform and that the facts cited by each speaker coincide with all the rest. In order to make the work of our men more uniform and keep them thoroughly up to date, we have inaugurated this system of normal institutes, taking the workers to the State experiment station and to the State College of Agriculture, where the instructors and experimenters at these institutions are asked to review the work of the past year in their various lines of scientific research. You institute workers are expected to take notes and in case anything comes up which you do not thoroughly understand you are expected to discuss the subject in open meeting, thus arriving at an understanding on disputed points and at the same time getting the latest accepted thoughts of the scientific men. You must receive benefit from this line of work. Mr. Flanders, the First Assistant Commissioner of Agriculture, will be here later; he is thoroughly posted on the Agricultural Law of the State and on the workings of the Department. The National laws relating to pure food, oleomargarine and kindred subjects are to be discussed and you are expected to post yourselves so that the usual questions regarding these can be answered intelligently. You must believe in the integrity of the Department. While Mr. Flanders will speak to us about the Agricultural Law, if there is anything you have in your mind as to its workings or administration, he will answer your questions, and I trust you will be free in asking him. If you do not feel like asking him in the meeting, go to him personally and talk the matter over with him.

As the time has already passed when we have expected to take up the regular work of the session, without further remarks I will introduce Dr. Webber, who is one of the newer men at the University.

Some Ideas on Plant Breeding.

By H. J. Webber, State College of Agriculture.

In considering this subject one of the things I think we ought to do is to compare plant and animal breeding, and some of the fundamental differences between them. We are more familiar with animal breeding than we are with plant breeding. In the case of animal breeding one seldom hears of a man attempting to breed a new race. The production of a new race of animals is so rare that it is a matter of history. Ordinarily speaking, we are satisfied with the dairy herd at the present time, taking the various breeds which already exist. In the case of any of our standard breeds the selection of the individual breeder is ordinarily within the confines of that race. The different individuals of the race vary considerably and the breeder is engaged in selecting the best. The plant breeder, on the contrary, ordinarily strives to produce new races or breeds, differing from the known sorts in some important characters, by which the new variety or race may be recognized. The new varieties or races of the plant breeder would correspond to the different breeds of animals. If a breeder produces a new type of wheat he wants some new character. He breeds to get some distinguishing characters, so that the main differences between the two types of breeding is that the animal breeder is breeding to develop strains within the race, while the plant breeder is breeding to develop new races or varieties. The striving after markedly new varieties has led the plant breeder to largely overlook the advancement that may be wrought within the variety by pedigree breeding. The plant breeder can handle thousands where the animal breeder handles tens. The plant breeder crosses different strains; he takes the most adverse things, things that belong to different species and even genera, and crosses them and produces very great variation.

Sugar-beet growers have been breeding sugar beets for increased sugar contents, and this work has been under way for half a century. We use two varieties, ordinarily the white Silesian, and the Kleinwanzlebener, a variety which originated in Germany. The selection in sugar beets has not been to produce new varieties differing from each other, but to produce strains within the variety, the same as in animal breeding. They are selecting sugar beets that have a certain content of sugar. For instance, a certain number of the beets run down to 3 or 4 per cent. of sugar while others give a maximum of, we will say, about 26 per cent., the ordinary mean running about 15 per cent. What the sugar beet breeder does is simply to test the various beets with reference to the sugar content, and discard those beets which are found to have a low per cent. of sugar, preserving as mothers only those which have the maximum sugar content. These are selected as mothers and grown to produce seed for general planting. This selection of the highest sugar content beets for mothers keeps up the average sugar content of the crop but has not produced new races of high sugar content, as this character is lost as soon as the selection is discontinued.

In careful pedigree breeding, the animal breeder follows both male and female parents, carefully selecting both. In the ordinary so-called pedigree breeding in plants, only the female parent is known and recorded, although through planting the breeding stock in isolated fields the male is known to have come from a good mother parent. In some special cases male and female are both followed in plants by practicing hand pollination.

In general, therefore, in plants the female is most generally followed, while in animals the male is, if anything, considered most important. In animals many herds are greatly improved by simply introducing a good male; in plants, many crops are greatly improved by simply selecting good females as seed producers.

The objects of careful plant breeding are, therefore, primarily:

First, the improvement of old races or strains. That is, the selection within the race without changing it, in order to increase and improve some quality of intrinsic value. This we may term strain breeding. And

PART OF A SOUTHERN EXHIBIT AT A STATE FAIR.

Second, the production of new races or varieties differing from each other by some taxonomic character. This we may call race breeding.

The fact that we are able to breed plants depends upon the occurrence of variations. Plants are by no means stable and unvariable, but are eminently plastic and variable. The small differences which normally occur between different individuals of the same race or variety and which are in no way dependent upon or caused by the environment are known as fluctuating or continuous variations. Until recently it was supposed that the advance in breeding was made primarily by selecting such variations year after year and obtaining a cumulative effect leading ultimately to a great variation from the original in the particular character under continuous selection. Recent investigations have rendered it doubtful whether the selection of these slight fluctuating variations really gives a cumulative result and indicates that by selecting such variations we are merely by isolation obtaining the maximums of the race in this character without changing the type or extremes of the race.

The recent investigations of De Vries directs the attention to the importance of a type of variations, that he calls mutations, which are apparently of prime importance in the formation of new races and varieties. Mutations are known to horticulturists and agriculturists as "sports." In the history of the varieties of almost any of our extensively cultivated plants we find reference to many varieties which have originated as accidentally discovered sports, which on cultivation were found to reproduce themselves true to seed and thus became the progenitors of new races. Such was the origin of the Gold Coin and Fultz wheats, two varieties well known in this State. We now seem to be drifting toward the idea that these striking variations or sports are of main importance in connection with our general breeding work. If we look over the history of cultivated varieties we find that a very large number of the new varieties have appeared suddenly, and seem to be mutations or sports. Mutations or sports are thus large pattern, striking variations which originate suddenly and reproduce themselves true to seed, especially in self-fertilized varieties. In cross-fertilized plants such sports, in considerable measure, would have been pollinated with other plants of normal type and would require to be grown and carefully selected to weed out the effect of such crossing in order to secure a pure strain of the sport. Suppose we find such a valuable mutation or sport in a cornfield, it becomes necessary for us to grow the progeny several generations and carefully select to the desired type in order to weed out the effect of crossing.

Let me illustrate this by timothy. We have been breeding timothy extensively at this experiment station and have some 20,000 plants, planted as individuals in hills. We find the plants vary one from the other remarkably. We have this year selected about 180 plants which represent a large number of different types. Professor Hunt while in charge of the work selected different types of this timothy and planted the seed of each plant separately. The plants from which the seed was taken were surrounded by other plants and were thus largely cross-fertilized. The seedlings from the plants selected by Professor Hunt are very variable. If the original types selected were mutations and had not been cross-fertilized they would probably have shown little variation. The great variation shown is thus probably in considerable measure due to the cross-fertilization. An interesting feature brought out by the examination of the progenies of the plants selected by Professor Hunt is that the characters of earliness and lateness of blooming are largely transmitted. The explanation of this is probably to be found in the fact that those plants that flower earliest will be pollinated with early plants, and those that flower late will be pollinated with other late-flowering plants; the result is that the character of earliness or lateness is largely transmitted, even when they are cross-pollinated.

A sport or mutation thus gives us immediately a new variety so far as its characters are concerned and simply requires to be grown to test its transmitting power and to weed out crosses and reversions. It thus appears that mutations are of value in producing new races, while the fluctuating variations are of value in the pedigree breeding of a race to secure the highest quality or yield of that race. The selection of sugar beets to improve and maintain a high sugar content is an illustration of such an improvement by pedigree selection, without the production of a new race.

What can we do toward forcing these variations? This is an important question which scientific breeders have to consider. We know that if we change the food of plants we are liable to break up the stability and cause the plant to vary. If we change the environment we are liable to increase the variability for some time. We know little as yet how far we can go in forcing variations other than through the hybridization of different strains. The evidence indicates that plants come more variable as they are highly fed, and are manipulated by budding, grafting and vegetative propagation. A change of environment may lead apparently stable species and races to break up and vary considerably. The recent investigations of Dr. MacDougal indicates that we may be able to produce or induce mutations or sports through the injection into the plant of chemical salts. This, however, is a field of experimentation for the scientist, rather than for the practical breeder.

Unity of the individual is another thing that the breeder should give attention to. It is a common thing for the cotton breeder to go into the field and select a certain good boll of cotton or the wheat breeder a good head of wheat. In some cases this policy is all right, and in other places it is all wrong. If you are working with corn where one ear represents the whole product of a plant, in selecting the good ear you are selecting the good plant. In the case of wheat, if you select the large head you may make progress. However, the large head may not be from the best yielding plant in the field. The one large head here may be large because it is the only head produced, while some of the plants around it may have many heads, in the aggregate giving a much larger yield. The man who selects one given boll of cotton because it is the best may be missing his opportunity entirely. The other bolls on the plant may be few in number and of poor quality. It is the individual as a whole that we want to follow. We should not select a certain boll but the entire plant that has a tendency to produce good bolls throughout and many of them. The wheat grower in general should select the plant that gives the variation that he wants instead of simply one head.

In general the individual is the unit of selection. The individual which shows a general tendency to produce the desired variation in all of its branches or fruits is better than the selection of a single fruit showing the desired variation from a plant where the other fruits are normal. There are, however, exceptions to this rule.

With reference to the principles of selection, you are all familiar with the fact that the keynote of improvement by selection is the choice of the very best. The discovery of the best plant requires the growing of very large numbers under uniform conditions so that the experimenter may have opportunity to examine and select the best. This policy may be carried out by either the field method or the nursery method. We have two schools practically on this manner of selection. Professor Hays in this country and Hallett in England have emphasized the necessity of giving each plant all possible opportunity to develop the maximum. For instance, Professor Hays plants wheat intended for selection in squares, placing the individual plants four inches apart. Mr. Hallett in England in 1850 used the same policy, with the exception that he carried it further and put the plants one foot apart instead of four inches, thus giving each plant every opportunity to develop to its maximum. It is doubtful whether this is altogether the true policy, because by this method you are cultivating the individual, as it were, in a garden. Some have claimed that we should breed our plants under the same conditions under which the crop is to be grown. We are always breeding plants for utility, and it is claimed that these selections should be made under field conditions where they are growing under normal field conditions. It is impossible to give definite directions as to which method to follow. The fact remains that by both of these methods good results have been obtained.

The experience of breeders has shown the necessity of having a clearly defined ideal type in mind in making the selections so that the objects of the selection will not be changed from year to year. It is desirable to write out a careful description of the type and use the same score card each year.

In all plant breeding work the test of the transmitting power of the selected individuals is a factor of primary importance. It is not only necessary that these selected plants have good qualities but they must possess the power of transmitting these good qualities to their progeny. This test is made by growing the selected plants by what is termed the plant-to-row method, the seed of each selected individual being planted in a single row, by the side of the other selected individuals. This enables the investigator to examine the progeny of each selected individual and make careful comparisons to determine which ones of the individuals first selected have given the best progenies.

In regard to making selections, I want to emphasize the importance of selecting for intrinsic qualities. In making the selections of the best individuals the investigator should be guided by a thorough knowledge of those qualities which go to make up a plant of the greatest intrinsic value. I have found all over the country too much of a tendency to select for what seems to me to be fancy features rather than qualities of intrinsic value. In many cases breeders have given primary attention to some quality which is entirely secondary in nature. The poultry fanciers, for instance, instead of selecting for intrinsic qualities in the past have selected for certain color of comb, wattles, etc., which are entirely fancy points for the show ring, and have no quality that better fits the chicken for egg production or for broilers. Corn breeders have given great attention to getting ears well filled out over the tip. This character is of no value except to produce a good ear for exhibit, and would be of no value there if the ordinary score card did not require it. Such a character is of no value unless it is correlated with heavy yield and the writer knows of no evidence to show that this is the case. What the corn breeder desires is the ear that matures the greatest amount of corn of good quality. If this happens to be borne on an ear well filled over the tip, well and good. The filling out over the tip is not a detrimental quality.

The breeding patch of varieties which are normally cross-pollinated should be placed in an isolated location to avoid crossing with unselected stock. In ordinary breeding in plants only the female is carefully followed generation after generation, but by placing the breeding patch in an isolated location, we at least know that the pollen comes from plants the mothers of which were carefully selected. Where the breeder depends upon hand pollinations there is of course no reason for isolation.

It is of little use to urge practical agriculturists to experiment in the production of new races and varieties by hybridization. To succeed in this field of breeding the experimenter must become a specialist and but few agriculturists and horticulturists will be in position to give the careful attention to the work which this line of breeding demands. To those who can, however, it is a field of exceptional interest.

I am sorry I have been unable to go further into these subjects, because I believe farmers ought to make breeding a fad. Every farmer cannot breed animals, but no farmer can afford to neglect the breeding of his planting seed. It is entirely possible for him to select his own seed on his own farm and greatly improve the strain which he is growing.

Mr. GOTT.— How long would you say a timothy plant would live under favorable conditions?

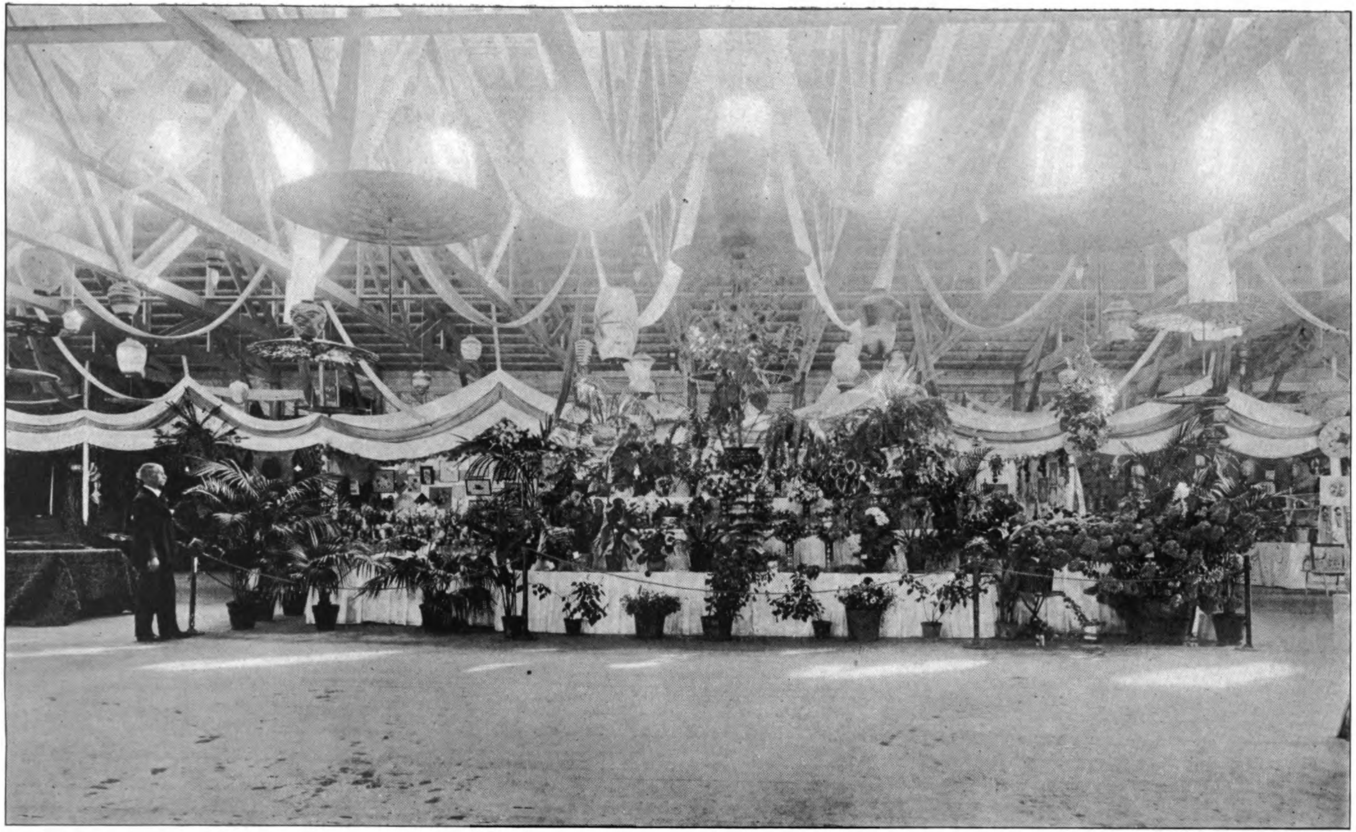
Prof. WEBBER.— We cannot tell you how long they will certainly live; six, seven or eight years, probably five years would be the average.

Mr. GOTT.— In this particular do you refer to male and female?

Prof. WEBBER.— Yes.

Mr. GOTT.— Which sex receives the prominence?

Prof. WEBBER.— We cannot tell at the present time. In our plants we pay more attention to the females or seed breeders, because we can handle them easily. If we were to say that the female is the most important in the transmission of characteristics, we do not know. The most scientific experiments indicate that there is very little difference in the effect of female or male in hybridization. In some cases there is a difference, but there is apparently up to the present time no rule.



Interior of Coliseum at a State Fair.

Some Ideas Regarding Soil Fertility.

By T. L. Lyon, State College of Agriculture.

Arguments have recently been advanced to support the old idea that the soil water solution contains a sufficient supply of mineral nutrients for maximum crops. It is stated that arable soils yield all of the necessary mineral plant nutrients to aqueous extractions. This is supported by the early investigations of Hoffmann, Helriegel, Peters and others. The soil water solution is, however, not the same as the soil extract. In the soil solution there is established an equilibrium between the solid matter of the soil and the solution when both are undisturbed. It is, therefore, argued that as all soils possess the necessary mineral nutrients there will always be a definite concentration of the soil water solution.

This means that the soil water solution of a poor soil is not essentially different from that of a good soil in its ability to produce crops. The difficulty in securing a sample of the natural soil water has made it impossible to determine its composition and concentration. Briggs has attempted to remove the water by centrifugal action, but the result has not been satisfactory.

Thus far the subject has been approached mainly through a study of aqueous extracts of the soil.

Whitney and Cameron found that aqueous extracts of good and poor soils did not vary essentially.

The following table from Bulletin 22, Bureau of Soils, illustrates their findings:

TABLE I.

CONDITION OF SOIL.	Moisture, per cent.	PARTS PER MILLION OF OVEN-DRIED SOIL.			
		Phosphoric acid (PO_4).	Nitric acid (NO_3).	Calcium (Ca).	Potassium (K).
Good wheat:					
First foot	14.2	2.90	13.22	14.33	24.36
Second foot	19.9	3.72	10.91	12.52	24.80
Poor wheat:					
First foot	14.7	4.72	15.34	7.91	35.40
Second foot	19.9	4.34	11.16	4.15	30.38

There are two possible sources of error in the work upon which is founded the hypothesis that all soils are equal in their property of supplying plant food materials:

(1) That the composition of the aqueous extract is not a measure of the available plant food nutrients.

(2) That the results are not representative of average soils.

The first of these objections depends in part upon the theory of plant root secretions, and will be discussed later.

The second is sustained by the few analyses that have been made of aqueous extracts of the soil.

Johnson in "How Crops Feed," quotes the following analyses:

TABLE II.

MATTERS DISSOLVED BY WATER FROM 100,000 PARTS OF VARIOUS SOILS.

	Lime.	Magnesium.	Potash.	Soda.	Phosphoric acid.	Chlorine.	Sulfuric acid.	Silica.	Organic matter.	Total.
Good soils	18	2	13	8	2	1	5	11	53	129
	34	7	8	13	......	7	9	22	36	136
	17	3	9	7.5	5	2.5	6.5	13.5	22	86
	23	1.5	7	4.5	1.5	1.5	1	38	30	108
Average	23	3.3	9.2	8.2	2.1	3.0	5.4	21.1	35.2	114.7
Poor soils	10	trace	1	2	......	trace	1	11	18	43
	8	0.5	0.5	3.5	trace	1	1.5	20	10	45
	1	2.5	2	1	trace	trace	trace	trace	33	39.5
Average	6.3	1.5	1.1	2.1	trace	1	1.3	15.5	20.3	42.5

King, working with eight types of soils located in both northern and southern states, obtained results supporting those quoted by Johnson. He reports as follows in Bulletin 26, Bureau of Soils, p. 118:

TABLE III.

CROPS YIELDS AND AMOUNTS OF WATER-SOLUBLE SALTS RECOVERED FROM THE SURFACE FOOT OF EACH OF EIGHT SOIL TYPES.*

	Janesville loam.	Miami loam.	Hagers-town loam.	Hagers-town clay loam.	Norfolk sandy soil.	Selma silt loam.	Sassafras sandy loam.	Norfolk sand.
Yields per acre:								
Corn, whole plant, pounds	16,911	13,336	10,121	9,583	6,804	6,323	6,277	5,412
Potatoes, bushels	290	237	157	168	48	70	93	102
Soluble salts, parts per million:								
Potassium	20.23	16.77	26.42	13.77	12.19	12.88	10.71	11.38
Calcium	96.79	91.17	96.21	114.20	38.67	54.87	52.39	39.62
Magnesium	30.40	29.93	33.99	43.80	12.64	12.70	10.95	10.31
Nitric acid	63.51	42.58	37.70	29.85	21.74	20.19	17.52	12.31
Phosphoric acid	24.56	16.40	16.94	16.61	10.73	10.87	10.55	10.98
Sulfuric acid	151.73	151.78	204.18	224.80	49.17	86.42	69.83	56.40
Carbonic acid	39.93	35.53	93.40	127.13	25.23	14.17	20.27	19.73
Chlorine	1.27	.87	.67	.87	1.47	2.00	1.87	1.40
Silicic acid	39.77	34.20	22.64	19.31	10.18	12.84	5.62	5.09
Total	468.19	419.23	532.15	590.34	182.02	266.94	199.71	167.22

* Results from these soils not obtained under the same climatic conditions.

While, therefore, the evidence is mainly opposed to the conclusions that the composition of the aqueous extract of the soil is a guide to the available mineral nutrients, and that such an extract is practically the same for all soils there is no experimental evidence to oppose the theory that the soil water is not a sufficient supply of nutrients for crops.

The solution in the soil water is constantly being depleted of its nutrients during the growing season by drainage or by absorption by plant roots or by both. According to the theory of equilibrium of solution, this could be made up by further solution of soil substance.

In substantiation of this, the fact is cited that successive leachings of a soil with water continue to yield, after a certain time, about the same quantity of substance to a given volume of water. Such an extract is exceedingly dilute and, as has been shown by Snyder, incapable of bringing to maturity a crop that would produce well on the same amount of soil.

This is not very strong evidence against the ability of the soil solution to supply plants, as the extracting water can never reach the point of equilibrium.

Soil extraction also fails to remove a certain amount of soluble salt retained by the soil through physical absorption. This depends quite largely upon the amount of surface exposed, and must be considerable for clay soils.

Analyses of the aqueous extract of a clay and of a sandy soil on the Cornell University Farm serve to illustrate the greater retentive power of the former for nitrates. Sodium nitrate was applied to Plat 728, on May 1, at the rate of 640 pounds per acre, and to Plat 14, on May 17, at the same rate. Plats 730 and 13 received no fertilizer.

TABLE IV.

Effect of Nitrate Fertilizers upon Soluble Nitrates in Different Soils.

Plat No.	Date.	Kind of soil.	Crop.	Fertilizer.	NO$_3$ p.p.m.
730	April 23	Clay loam	Timothy	None	8.2
728	April 23	Clay loam	Timothy	None	12.3
730	May 3	Clay loam	Timothy	None	4.1
728	May 3	Clay loam	Timothy	Na NO$_3$	51.6
730	May 14	Clay loam	Timothy	None	3.3
728	May 14	Clay loam	Timothy	Na NO$_3$	97.4
730	July 24	Clay loam	Timothy	None	2.2
728	July 24	Clay loam	Timothy	Na NO$_3$	6.5
13	Aug. 5	Sandy loam	Corn	None	18.1
14	Aug. 5	Sandy loam	Corn	Na NO$_3$	210.1
730	Aug. 14	Clay loam	Timothy	None	1.8
728	Aug. 14	Clay loam	Timothy	Na NO$_3$	7.8
13	Aug. 19	Sandy loam	Corn	None	29.7
14	Aug. 19	Sandy loam	Corn	Na NO$_3$	150.0

There is much in favor of the idea that the soil water is a fairly strong solution. Solubility is proportional to surface exposed. King points out that a clay soil may have a surface of over three acres on the particles contained in a column one foot square and four feet deep.

The water acts not only as a solvent, but also as a chemical reagent upon the silicates and alumino- and ferro-silicates of the alkalis and alkali earths through hydrolosis, nitrification and other bacterial action, organic matter, dissolved gases, carbon dioxide forms bicarbonates with bases and increases solubility by decreasing the amount of hydroxides, changes of temperature, etc.

Theory of root secretions. It has been held quite commonly but not universally that plant roots secrete organic acids which act upon mineral substances in the soil dissolving them and thus adding to the concentration of the soil solution and to the supply of mineral nutrients. If the theory of the sufficiency of the soil water solutes for plant nourishment is admitted, the uselessness of root secretions is apparent. A number of phenomena have been held to prove the excretion of organic acids by roots.

(1) Action of roots of lichens and other plants on smooth rock surfaces, marble, granite, etc. It is urged against this that the action is due to carbonic acids following the roots.

(2) Plants grown in water cultures leave the solution acid. In reply it is said that the selective power of the plant root by which a larger quantity of bases than acids is removed accounts

for this. It is also stated that where a considerable supply of nitrates is present the solution may become alkaline.

It cannot be said to be definitely proven that organic acids are secreted.

If the soil water has practically the same composition in all soils, and this solution contains more mineral nutrients than is required to raise a maximum crop, it is evident that the practice of manuring soils is quite useless as a means of furnishing nutriment to the plant.

The very apparent benefit from the use of fertilizers has been attributed by adherents of this theory to other effects upon the soil.

(1) That the fertilizer by increasing temporarily the concentration of the soil water solution enables the young plant, with its small root system, to obtain more nourishment than it otherwise would. While with a larger root system this is not necessary.

(2) A change in the ratio of nutrients in solution.

(3) To affect the organic constituents in such a way that they are harmless.

In investigating the influence of fertilizers upon the soil water, the difficulty of obtaining a sample of the water is again encountered.

Aqueous extracts made by Whitney and Cameron of manured and unmanured soils indicate that the application of manure does not increase the soluble nutrients. The fertilized soil received 400 pounds of bone and potash per acre. Samples for analysis were taken four days after applying fertilizers.

TABLE V.

CONDITION OF SOIL.	Moisture, per cent.	PARTS PER MILLION OF OVEN-DRIED SOIL.			
		Phosphoric acid (PO_4).	Nitric acid (NO_3).	Calcium (Ca).	Potassium (K).
Fertilized:					
First foot	8.1	6.60	7.70	9.90	25.74
Second foot	10.4	3.36	2.57	7.50	23.30
Not fertilized:					
First foot	9.0	3.85	4.90	8.63	20.90
Second foot	9.7	3.92	1.80	11.20	21.00

Results obtained by King when working with the same soils do not agree with Whitney's and Cameron's analyses. The following table shows the mean amounts of water-soluble salts recovered from the surface foot of eight soil types with different amounts of fertilizers. Determinations of soluble salts were made at different times during the season in soil taken from under the corn and potato crops.

TABLE VI.

FERTILIZATION.

	FERTILIZERS.				
	Nothing.	5 tons manure.	10 tons manure.	15 tons manure.	300 lbs. guano.
Crop yield per acre:					
Air dry corn stalks and ears, lbs.	7,686	9,302	10,460	10,772	8,506
Potatoes, bushels	111	146	165	175	130
Moisture in soil:					
Per cent	19.03	19.30	18.92	19.48	19.49
Inches	2.65	2.68	2.64	2.66	2.65
Salts soluble in water, p.p.m.:					
Potassium	14.04	15.37	16.17	17.36	14.78
Calcium	69.30	69.37	70.74	74.27	81.23
Magnesium	21.44	22.11	23.60	24.22	24.07
Nitric acid	29.12	30.95	30.47	32.47	30.38
Phosphoric acid	13.98	14.73	16.04	15.01	13.77
Sulfuric acid	115.40	116.32	118.31	125.02	146.28
Carbonic acid	38.00	44.94	49.30	49.54	52.85
Chlorine	1.12	0.92	1.21	1.84	1.42
Silicic acid	19.04	19.28	18.80	17.93	18.49
Total	321.44	333.99	344.64	357.71	383.27
Total soluble salts, lbs., per acre	1,027	1,070	1,098	1,186	1,230
Increase of water-soluble salts	....	43	71	159	203
Increase of corn	....	1,716	2,774	3,086	820

Our own results indicate that, so far as nitrates are concerned, the addition of these salts adds considerably to the concentration of the soil solution and that the effect is noted for a long time. Such soluble salts as potassium chloride and rock superphosphate have not increased materially these solutes in the soil water.

The following table shows the amounts of certain substances in extracts of soils, on the Cornell University Farm, to which corresponding fertilizers had been applied on May 17 of the year in which the analyses were made. The applications were at the rate of 640 pounds per acre of sodium nitrate, 320 pounds rock superphosphate and 80 pounds of muriate of potash.

TABLE VII.

EFFECT OF FERTILIZERS UPON SOLUBLE SALTS IN SOIL WITHOUT CROP.

FERTILIZER PER ACRE.	Constituent determined.	July 9	July 16	July 30	Aug. 12	Aug. 26
No fertilizer	NO_3 p.p.m.	57.5	30.0	81.6	78.6	41.5
Sodium nitrate	NO_3 p.p.m.	238.8	162.5	221.0	208.0	137.5
No fertilizer	PO_4 p.p.m.	7.8	9.7	7.2	7.2	9.0
Acid phosphate	PO_4 p.p.m.	9.7	11.0	7.8	6.0	10.2
No fertilizer	K p.p.m.	10.4	7.1	4.5	4.8	6.0
Potassium chloride	K p.p.m.	9.1	5.2	9.0	6.6	9.6

A practical difficulty in securing information on this subject is in accurately determining the amounts of K and P in such dilute solutions.

The question cannot be said to be settled for K and P, but in the case of nitrates there can be no doubt that the addition of nitrate fertilizers increases the amounts of those salts in the soil extract.

PRESENCE OF TOXIC SUBSTANCES IN SOILS.

The reason last mentioned to account for the benefit derived from fertilizers depends upon the properties which these are said to possess by which they render inocuous certain organic substances that are injurious to plant growth.

That such substances exist in the soil has been held by a few men for many years. DeCandolle was the first to advance the idea in 1832. Lately it has been reiterated, accompanied by some experimental evidence, by the Duke of Bedford and Mr. Pickering of the Woburn Experimental Fruit Farm and by several members of the Bureau of Soils.

The work of the first two investigators began with the observation, in 1897, that fruit trees under which grass was allowed to grow made a poorer growth than those under which no grass was permitted. The effect was much more pronounced in the case of grass than of weeds.

Control of the moisture supply, nutritive materials, temperature and of soil aeration, by means of cement and iron bands over the surface of the soil, failed to show any such injurious effect as was produced by grass. The tree roots, also, showed an unhealthy appearance. They conclude that the injurious substances are the result of grass growth. Later reports attribute them to bacteria.

The work of the Bureau of Soils began with observations upon the injurious effect of trees upon grass.

They find that by growing wheat seedlings in water cultures the cultures become less suited to the growth of wheat with each successive generation, even when the nutrient materials are restored.

When these solutions are treated with certain substances, such as carbon black and ferric hydrate, the injurious properties are removed. These are thought to act as absorbents of the toxic substances. The possible beneficial effect cannot, they think, be due to a mechanical stimulation of the plant, as the beneficial action continues after the solid has been filtered out.

Several unproductive soils have been studied from this standpoint. The aqueous extracts of these soils have been used for growing plants. In each case the addition of absorbents, whether left in the cultures or filtered out, have produced a better growth than was obtained in the untreated extracts.

It may be mentioned that the tests of plant growth have in the reported results of the Bureau of Soils been confined to a few weeks' growth and comparisons are based on transpiration or green weight. They find that cultures made with all the terrestrial waters they used produced better growth when the water had been treated with an absorbent than when it had not.

Even distilled water is not free from the presence of toxic substances. Redistillation in glass, even when this was done from sulphuric acid and potassium dichromate, and then from alkaline potassium permanganate, did not remove the toxic substances as satisfactorily as did the addition of an absorbent.

It is contended that soil acidity is an indication of the presence of these toxic substances, that the injury which plants suffer on such soils is due primarily to the action of the toxic substances, not to the acid, and that the benefit from lime, or at least from air slacked lime, is due either to some physiological property of the salt by which it counteracts the effect of the poisons, or the effect of the calcium carbonate upon the toxic materials themselves. It is claimed that most soil extracts are alkaline, after carbon dioxide has been driven off.

There is no occasion to recommend at present any change in the customary approved practices of soil management, as these ideas are still hypothetical.

At the same time, the importance of the subject and the character of the work that is being done requires that we keep our minds in a receptive attitude toward any further discussion of the subject.

If it be true that fertilizers are unnecessary as carriers of mineral nutrients, and that their benefit to crops is due to their action on toxic substances, it would seem probable that they would soon be replaced by more effective or less expensive materials.

To the farmer it would doubtless mean a cheaper and more effective substitute for commercial manures, and consequently larger crops. On the present evidence, however, it would be very unwise to hold out any such promise.

Future Commercial Sources of Nitrogenous Plant-food.

By Dr. L. L. Van Slyke, State Experiment Station.

You remember how, in 1898, Sir William Crookes startled us all for a brief time by predicting the exhaustion of the nitrate supply of the world in about thirty years and a prospective world famine, consequent upon the increase of population and, sooner or later, a gradual decrease of the world's necessary food supply, unless new and abundant sources of nitrogenous plant-food should be found. It was held that a cheap source of nitrogen directly available as plant-food must be discovered in quantities sufficient to accomplish two things: (1) To supply the place of the nitrogen taken from the soil by crops; and (2) to increase the power of the soil to grow a larger amount of nitrogenous food per acre than is now done.

Before that time, chemists had busied themselves with the problem of obtaining nitrogen from the air for agricultural and manufacturing purposes, but without success. Modern chemistry is heir to the alchemy of olden times, when men were searching for the elixir of life, by means of which the human race could be kept perpetually young. In consequence of the transformation of alchemy into chemistry, it may be said that we have been continuing the search for an elixir of life, somewhat modified, to be sure. The modern elixir of life has been sought in the atmosphere as something that would make more abundant our sources of sustenance and keep perpetual our annual harvests. Happily, the developments of the past few years indicate that the elixir of plant life can be obtained from the air and that new commercial supplies of nitrogen are thus becoming rapidly available.

Questions are constantly being asked about these materials and it is desirable that you should be in possession of some reliable facts regarding this important subject, instead of relying upon such accounts as may appear in newspaper and magazine pseudo-scientific articles, so often distinguished for high literary polish and statements that too often are not so.

COMMERCIAL SOURCES OF INORGANIC NITROGEN COMPOUNDS USED IN AGRICULTURE.

It will be a matter of interest to consider briefly our usual sources of inorganic nitrogen compounds available for agricultural purposes, in order that we may appreciate more fully our urgent need in the near future of new sources of supply. The discussion is limited to what may be called inorganic nitrogenous compounds, because we are considering only those sources of supply that do not come from the soil itself. We do not need to consider the animal and vegetable sources of nitrogen used in agriculture, because they come from the soil itself.

Two main sources of supply of commercial inorganic nitrogen compounds, used in feeding crops, are nitrate of soda from Chili and sulphate of ammonia.

NITRATE OF SODA.

The annual output of nitrate of soda is about 1,600,000 tons, of which agriculture uses about four-fifths, or 1,300,000 tons, and agricultural requirements steadily increase rather than otherwise. The amount of nitrogen in the entire annual output of the nitrate of Chili is only about one-fifth the amount of nitrogen used by one wheat crop in the United States. Recent calculations indicate that the Chili beds will be practically exhausted in 1923, or in about sixteen years, somewhat sooner than Sir William Crookes calculated. There has been thorough and extensive searching for other deposits like those in Chili, but none has yet been found. Deposits are known to exist in California but they are not sufficiently rich in nitrate to pay for working, and thus far have proved profitable only to gifted promoters who are skillful in catching human suckers desiring to reap enormous profits, while, at the same time, helping out agriculture. We can thus see that, so far as we know, natural nitrate deposits hold out little encouragement for long-continued future supplies.

SULPHATE OF AMMONIA.

Ammonium sulphate is produced as a by-product in the manufacture of illuminating gas and coke. In the past, large amounts of ammonia have been allowed to go to waste in the manufacture of coke, but the present tendency is to save it. The amount of sulphate of ammonia now produced in the United States is about 60,000 tons a year, and only a small proportion of this is available for agriculture. Of the total nitrogen contained in coal, only 10 to 15 per cent. is obtained in the form of ammonia. Expressed in another form, one ton of coal produces from eight to twenty-five pounds of sulphate of ammonia, equivalent to 1.6 to 5 pounds of nitrogen. The amount of ammonia that we may hope to obtain from this source can hardly be regarded as either extensive or permanent for future supplies.

Some years ago experiments were made in obtaining ammonia from the garbage of large cities and considerable hope was felt that ammonia might thus be abundantly and cheaply produced; but the attempt appears to have been a failure, at least from a commercial standpoint.

ATMOSPHERIC NITROGEN.

It has been recognized for some time that in the future we must come more and more to depend for the nitrogen compounds required for agricultural purposes upon the inexhaustible supply of nitrogen contained in air.

The element nitrogen is chiefly distinguished for its chemical indifference and inactivity; it prefers to maintain its individuality apart from other elements and remain as free nitrogen rather than tie up with other elements in the form of compounds. In other words, nitrogen has strong tendencies to bachelorhood and it can be enticed out of this condition only by unusual attractions or special affinities. In its uncombined state, as it exists in the air, nitrogen is useless as plant-food, at least, so far as we know. The problem is, therefore, to cause atmospheric nitrogen to combine with other elements and form compounds in which the nitrogen can be utilized by plants as food. In order to be of commercial value, a process which successfully solves this problem must produce nitrogen compounds cheaply and in large amounts.

DIFFERENT METHODS FOR UTILIZING ATMOSPHERIC NITROGEN.

Up to the present time, four methods have been found for combining atmospheric nitrogen with other elements. One is bacterial, and the other three are chemical. The bacterial method has been frequently discussed in these meetings, and need not be further considered in this connection.

Of the three chemical methods, two have been commercially developed, while one is still in an experimental state. It will answer our purpose to confine our attention to the two methods in commercial operation.

Before considering in detail these commercial processes for preparing nitrogenous plant-food compounds by use of atmospheric nitrogen, it may be of interest to touch briefly upon the historical phase of the problem. The first experiments which form the starting point in one solution of the problem were performed by Cavendish, and also by Priestly, between 1780 and 1790. These experiments were what we call purely scientific in character, the experimenters having no thought of the applications of nitrogen compounds, because at that time the relation of these compounds to agriculture was understood little, if at all. However, it was necessary that some one should discover the facts established by these experiments, before it was possible to begin to solve the problem which is now of so vital practical importance. This is only one of thousands of cases which furnish illustrations of the truth that we must first find out facts before we can apply them practically. The work necessary to discover such fundamental facts may seem to the layman like wasted time, but sooner or later its necessity is fully demonstrated. These facts lay quietly in the records of science for over a century, waiting for the time when they should be called forth to meet the most urgent needs of mankind. But they were ready, when called, and formed the fundamental starting point in the solution of the greatest of world problems, that of feeding our crops and mankind. It was not until 1895, twelve years ago, that definite progress began to be made. The technical methods for producing nitrogen compounds by the use of atmospheric nitrogen have been developed with the last ten years, and, it might be more accurate to say, since 1900.

Before concluding these historical statements, I ought to add some information which was imparted to me a few years ago, and which has not yet appeared in any scientific or technical journal. If I remember correctly, my informant was an institute worker. Somewhere in the western part of the State, near Springville, I think, there dwelt an eccentric individual who was looked upon locally as a kind of chemical wizard. He was devoting his life, in great seclusion, to the solution of various profound problems and, among them, the method of obtaining nitrogen from the air in the form of useful compounds. He had succeeded and was almost frightened at the possible results of his success. He had discovered a liquid which, when applied to ordinary coal ashes, would rapidly draw nitrogen from the air, resulting in the formation of ammonia. The ammonia had actually been smelled by some one who had been present when the ashes were treated with the wonderful and mysterious liquid. The operation when once started would go on continuously and produce ammonia on ammonia. There was danger, so the wizard said, in allowing the operation to escape from control. He, therefore, strangled it in some way before it had continued long. The great danger in allowing the operation to go unchecked was that it would get beyond all control and, sooner or later, use up atmospheric nitrogen to such an extent that the air would be understocked with free nitrogen and overstocked with oxygen and ammonia. The equilibrium of ages would be destroyed, with alarming results to the environment of all animal life on earth. Before utilizing his process for commercial purposes, he was trying to discover means of controlling it. This was some years ago. Since nothing further has been heard of the matter, it is probable that this genius, if still living, has not yet solved the problem of control. If his process should once break loose from its stable, more dire results would follow than the accidental escape of the gypsy moth in Massachusetts. Any historical treatment of our subject would not be complete without a proper presentation of these facts.

In connection with the two processes to be discussed, we will have to consider the following points: (1) The substance produced, (2) the method of production, and (3) the suitability of the product as nitrogenous plant-food. In considering the method of production, it would hardly be advisable here to go into the details; these are of interest to mechanical and chemical engineers, but are rather too technical for our present purpose.

CALCIUM CYANAMID.

The first substance we will consider is known by the chemical name of calcium cyanamid and by the common name of lime nitrogen. This compound, in chemically pure condition, contains 35 per cent. of nitrogen; but the commercial product, known as lime nitrogen, is not pure, varying in content of nitrogen from 14 to 22 per cent., the higher percentage being obtained by the latest modifications of the process.

METHOD OF MANUFACTURING LIME NITROGEN.

The materials used in preparing lime nitrogen are (1) calcium carbide, the product so familiar to us in the production of acetylene gas, and (2) pure nitrogen obtained by liquefaction of air and distillation of the liquefied air. The nitrogen is passed over heated calcium carbide and combines with it more or less completely. In later modifications of this process, calcium chloride or calcium fluoride is mixed with the carbide. The product resulting from the process is a mixture of calcium cyanamid and carbon. The change can be represented as follows:

64	28	80	12
$Ca\,C_2$ +	N_2 =	$Ca\,C\,N_2$ +	C
Calcium carbide	Nitrogen	Calcium cyanamid	Carbon

Theoretically, 100 pounds of calcium carbide combine with 43¾ pounds of nitrogen to produce 125 pounds of calcium cyanamid and 18¾ pounds of carbon, or 143¾ pounds of lime nitrogen, containing about 30 per cent. of nitrogen. But the combination of nitrogen is not complete according to theory, owing to defects in the process. Hence, the mixture produced, known as lime nitrogen, contains much less than the theoretically possible amount of combined nitrogen, varying, as previously stated, from 14 to 22 per cent.

CONVERSION OF LIME NITROGEN INTO PLANT-FOOD.

The calcium cyanamid in lime nitrogen is not directly used as such by plants. It is interesting to notice the general change which it undergoes before it is directly useful as plant-food. There are some details which can just as well be omitted here, the main fact being kept in mind that the nitrogen of calcium cyanamid changes into ammonia. This change we will now study briefly.

When calcium cyanamid is heated in contact with water under pressure, it gives off ammonia readily, forming, in addition, calcium carbonate (carbonate of lime). This change can be represented in the following manner:

$$\begin{array}{cccc} 30 & 54 & 34 & 100 \\ \hline \mathrm{Ca\,C\,N_2} + & 3\,\mathrm{H_2\,O} = & 2\,\mathrm{N\,H_3} + & \mathrm{Ca\,C\,O_3} \\ \text{Calcium} & \text{Water} & \text{Ammonia} & \text{Calcium} \\ \text{cyanamid} & & & \text{carbonate} \end{array}$$

For each 100 pounds of calcium cyanamid used, 67½ pounds of water would be used and there would be formed 42½ pounds of ammonia and 125 pounds of carbonate of lime. One ton of lime nitrogen containing 20 per cent. of nitrogen would combine with 270 pounds of water, furnishing 170 pounds of ammonia and 500 pounds of carbonate of lime.

Now, this change which takes place when calcium cyanamid is heated under pressure in the presence of water, also takes place when lime nitrogen is distributed in moist soil but much more slowly. I do not know that we can yet regard as settled the question as to whether this change, when it occurs in soil, is a simple chemical change, similar to that produced by treating calcium carbide with water in the production of acetylene gas, or whether it is produced only by the instrumentality of bacterial action. The latter view appears to be the prevailing one, supported by a considerable array of facts.

USE OF LIME NITROGEN AS PLANT-FOOD.

The suitability of calcium cyanamid, in the form of lime nitrogen, for plant-food depends upon two factors, (1) its cost and (2) its action upon plant growth.

The latest obtainable figures give the cost of this form of calcium cyanamid as $54 to $63 a ton, when produced under favorable conditions. This means that each pound of nitrogen costs thirteen and one-half to fifteen cents, which is about the average cost of nitrogen in nitrate of soda. Of course, the main cost is calcium carbide, and it is possible that the cost of its production may be decreased. If the material is found to be a thoroughly desirable form of nitrogenous plant-food, it is highly probable that its cost will be considerably reduced. This end is, of course, being worked for constantly.

For three years past, considerable experimental work has been done, mostly in Germany, in testing the value of nitrogen in the form of calcium cyanamid for use in feeding plants. As might be expected, somewhat varying and contradictory results have been reported by different investigators; but, on the whole, and more particularly in the later experiments, the reports are quite favorable.

The following objections have been urged against the desirability of the use of calcium cyanamid as a plant-food:

(1) It absorbs moisture readily and, therefore, on standing some time it forms a hard mass, difficult and disagreeable to handle as a fertilizer.

(2) It loses ammonia on standing and is, therefore, not suitable for application in late fall or winter.

(3) It injures soil bacteria and especially nitrogen gatherers.

(4) It injures seeds and prevents germination when applied at or near the time of planting.

(5) It cannot be applied in mixtures with other fertilizing materials on account of its tendency to absorb moisture and cause caking. It must, therefore, be applied by itself.

(6) It is not suited for top dressing, as in case of grass lands, since direct contact with grass produces injury.

(7) Forcing crops, during their early stages of growth, are sensitive to the presence of calcium cyanamid, and may be unfavorably affected by it.

(8) It does not appear to work efficiently in soils rich in humus, or in acid soils, unless used along with considerable carbonate of lime.

On the other hand, the following favorable features have been extensively reported by different experimenters:

(1) The crop-producing efficiency of calcium cyanamid, under ordinary conditions, with field crops is from 75 to 90 per cent. of that of nitrate of soda and not much below that of sulphate of ammonia. On garden crops the efficiency was about the same as that of nitrate.

(2) On clay soils, lime nitrogen is nearly as efficient as nitrate of soda. On sandy soils, it needs to be used with caution on account of liability to cause burning of crops.

(3) Owing to recent improvements in methods of manufacture, it is claimed that the material does not absorb moisture and does not lose ammonia on standing.

(4) Calcium cyanamid forms ammonia in the soil quite rapidly, the rate varying according to conditions. The conversion of its nitrogen into ammonia is reported in one case as complete in twenty-three days, in a loam soil, at ordinary temperatures. In sandy soils the change is much slower.

(5) This material can be safely used in quantities varying from 135 to 270 pounds an acre, but it should be applied eight to fourteen days before putting in the crop and thoroughly mixed with the soil to a depth of three to five inches. The injurious effects on seeds can be overcome to a large extent, also, by mixing the lime nitrogen thoroughly with two or three times its weight of fine, dry earth or other inert material before applying to the soil.

We may, therefore, conclude that in calcium cyanamid, in the commercial form of lime nitrogen, we have a source of nitrogenous plant-food which, when used with proper precautions, may do efficient work in promoting plant growth. We can, at least, regard it as a very promising material, which will be found valuable as a source of agricultural nitrogen, in case we are unable to find something equally or more efficient, and, at the same time, free from the inherent drawbacks which this substance seems to possess. In this connection it will be interesting to know that the material is to be exploited in this country by the American Cyanamid Company.

CALCIUM NITRATE.

The second substance we will consider in relation to nitrogenous compounds prepared by the use of atmospheric nitrogen is known under several different names: Calcium nitrate, nitrate of lime, basic calcium or lime nitrate, basic nitrate, lime niter, etc. It is a compound closely related to nitrate of soda; in calcium nitrate, we simply have calcium instead of sodium combined with nitric acid. Strictly pure calcium nitrate contains 17 per cent. of nitrogen, a little more than is contained in pure sodium nitrate. The commercial product actually contains 12 to 14 per cent. of nitrogen, since it is not pure calcium nitrate, but a mixture of this compound with lime.

METHOD OF MANUFACTURING BASIC NITRATE OF LIME.

Briefly stated, the process of manufacturing basic nitrate of lime consists of the following steps: (1) Ordinary air is passed through a powerful electric flame or arc, resulting in the combination of much of the oxygen and nitrogen in the form of nitric oxide. (2) This nitric oxide, on exposure to air, combines with more oxygen, forming other oxides of nitrogen. (3) These last formed oxides of nitrogen, on treatment with water, form nitric acid. (4) The nitric acid treated with lime forms lime nitrate.

The materials required by this process could hardly be simpler or less costly, consisting of only common air, water and lime. A high degree of heat, produced by electric power, is the energy used. The details of the various steps of the process are very interesting from a technical point of view but we do not need to consider them here.

That portion of the process in which the nitrogen and oxygen are caused to combine appears to be less expensive than the subsequent portion of converting the oxide of nitrogen into nitric acid and nitrates. In its essential elements, the process is seen to be a simple one. The only expenses to be considered are: (1) Electric power, (2) lime and (3) current manufacturing expenses. The raw material which is consumed in largest quantities, the air, costs nothing.

Many patents have been taken out in connection with the electro-chemical production of nitrogen compounds from air. The patent of Bradley and Lovejoy was exploited by the Atmospheric Products Company of Niagara Falls, and we heard much about it a few years ago. No one could obtain more than a vague knowledge of what was being done, but we were led to suppose that the process was successful and that soon large supplies of nitrate nitrogen would be available at our door. This company stopped work in 1904, not having succeeded in producing nitrate nitrogen at a price which would enable it to compete with our usual sources of supply.

As nearly as can be ascertained, the best results have been obtained by the Birkeland-Eyde process, which is in operation on a commercial scale at Notadden, Norway. The necessary electrical energy is furnished by water power. The company which is back of this enterprise has gained control of most of the available water power of Norway and proposes to increase the number of manufacturing plants as rapidly as practicable.

USE OF CALCIUM NITRATE FOR AGRICULTURAL PURPOSES.

The chemical substance known as calcium nitrate has a powerful attraction for moisture, but this is overcome by treatment with excess of lime. I believe they use an excess of about 2 per cent. This so-called basic lime nitrate powders readily and does not absorb moisture seriously.

The cost of basic calcium nitrate at the works, not including packing and transportation, is about $30 a ton, which would furnish nitrate nitrogen at about ten cents a pound. It is expected that its cost of production will be reduced to seven and one-half cents a pound. Even adding the cost of packing and transportation, the price compares most favorably with nitrate of soda. It is probable that it will be a strong competitor with the older sources of supply.

Basic nitrate of lime has been shown by numerous experiments to be fully equal to nitrate of soda as a nitrogenous plant-food. As compared with nitrate of soda, basic nitrate of lime has certain advantages as a source of plant-food: (1) When basic nitrate of lime is applied to soils, it leaves carbonate of lime as a residue and this may be regarded, in general, as of more agricultural value than the sodium compounds left by nitrate of soda. (2) Basic nitrate of lime will probably be cheaper than nitrate of soda, if it is not already. The chief question for the future would appear to be an increase in the number of factories sufficient to meet the future demands and this will naturally adjust itself.

It would, therefore, appear that we do not need to fear any famine in the future that might come from a lack of supply of nitrogenous plant-food for growing our crops.

FUTURE POSSIBILITIES IN COMMERCIAL PRODUCTION OF NITROGENOUS PLANT-FOOD.

Lime nitrate, as well as nitrate of soda, has the disadvantage of bulk. For each pound of nitrogen, one must pay transportation on six or seven pounds of cheap material. A further problem in the production of cheaper nitrogenous plant-food is the economical manufacture of a compound richer in available nitrogen. Such a compound is found in ammonium nitrate, which is probably the most concentrated form of nitrogen that would fulfill all the demands of the problem. In this compound we have both ammoniacal and nitrate nitrogen. The total amount of nitrogen is about 35 per cent., equally divided between the two forms of nitrogen. A good commercial product containing about 33 per cent. of nitrogen would reduce one-half the cost of transportation which must be met in the case of nitrate of soda or of lime nitrate. The solution of this problem must be the economical production of ammonia and nitric acid in the same factory. It resolves itself, in reality, into the question of producing ammonia cheaply. It is possible that calcium cyanamid may be utilized in this way, if it can be produced much more cheaply.

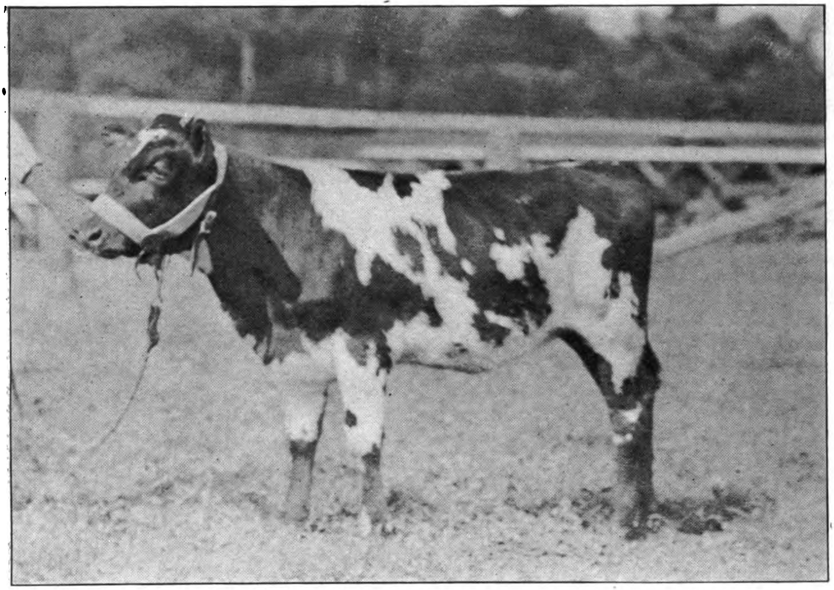
The Milking Machine.

By George A. Smith, State Experiment Station.

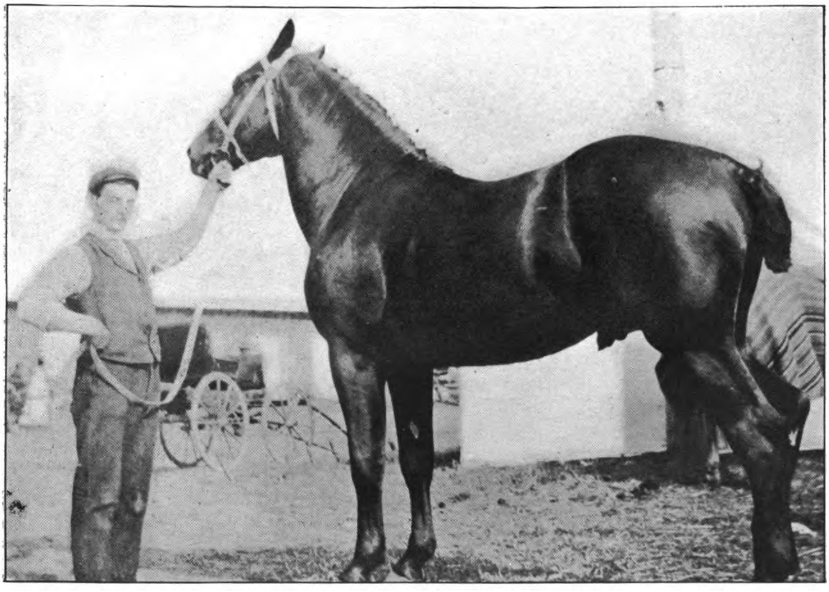
Last year, when I gave you the results secured from the use of the Globe milking machine on the station herd at Geneva, you will remember that it was not a satisfactory record and that the use of the machine had been discontinued. Soon after that meeting the question of giving the Burrell-Lawrence-Kennedy cow-milker a test came up and after a little time arrangements were completed for doing so. We began the use of this machine March 8, 1907, and have been using it continuously since that time with all of our cows.

You may think that with this experience we should give definite advice as to the merits of the machine. We do know some more but there are so many things which we do not know. It would not be wise to recommend you to say to the dairy farmers of the State of New York that milking cows with a machine is a success. The time that we have used it would not warrant such a statement. There are too many problems involved that can only be settled by an experience covering a much longer time. The most difficult point to determine is the effect of the machine-milking on the present and prospective flow and richness of the milk. It is difficult to determine what the cow might have done with hand-milking. We have observed quite a difference in some of our cows in the way they milk out with the machine, some of them giving their milk down much more freely than others.

After starting the machine one cow requires no attention, only a very little manipulation of the udder at the last, to see that she is milked out clean. For most cows the machine is set to make about fifty-five pulsations or breaks in the vacuum per minute, which is all right for the free milking cow, but for the cow that milks hard or does not give her milk freely it is sometimes neces-



Ayrshire Heifer Calf.



German Coach Horse.

sary to make the breaks in the vacuum slower. This requires more attention and manipulation of the udder to milk the last cow as successfully as the first. If the person in charge is not a close observer and does not look after all those things the working of the machine will not be satisfactory but it is the fault of the man and not the machine.

Alternate milking by hand and with the machine for short periods does not furnish data of very much value. The best method of comparison is to take periods of lactation, and even then so many other things may affect the health and condition of the animal that it is not easy to form correct judgment. This is illustrated by conditions with us the past two seasons. Last year there was rain and plenty of green food, this year, drought which compelled us to feed hay a part of August and September. For making a comparison I have taken the yield of milk of five cows which came fresh a year ago and this year in March and April, taking an equal number of weeks in each year.

	Milk 1907.	Milk 1906.	Giving Nov. 12.	Per cent fat.
Ruth	5886	5072	18.1	5
Carey	3687	3696	8.	7
Princess	4196	3332	11.7	5.5
Fanny	4565	4492	14.5	4.8
Dolly	3819	4404	18.1	6

Mr. DAWLEY.— How old is Ruth?

Mr. SMITH.— Three, last year. Princess is a four-year-old; Carey is a four-year-old; Fanny is a six-year-old; Dolly is an eight-year-old.

Mr. DAWLEY.— Can you see any reason for her giving five hundred pounds less this year than last?

Mr. SMITH.— The only reason that I can give is that last year Dolly made her best record. She gave nearly 9,000 pounds, and pretty close to 600 pounds of butter. She milked up to time of freshening. And as usually happens she has not done as well as last year.

Mr. VAN SLYKE.— Did her period of lactation begin the same time both years?

MR. SMITH.—About the same time. I took these cows because the period of lactation started in March and April and all of them about the same time.

MR. DAWLEY.— Do you remember how many weeks this period covers?

MR. SMITH.— Somewhere between twenty-six and twenty-eight weeks. It is a record of an equal number of weeks in the two years. You can see from those figures that that really doesn't show very much.

MR. FULLER.— You would have to have more cows than that and have the same climate and pasture conditions.

MR. SMITH.— You certainly have got to have just about the same conditions during each year.

MR. VAN SLYKE.— The results appear to me, taking the seasonable conditions, more normal in the case of Dolly than the others. Why it does not appear in those other cases, is not clear.

MR. SMITH.— Because last year the others were three-year-olds, and they never are inclined to do as well as four-year-olds. That would account for the main part of the difference, I think.

MR. VAN SLYKE.— How much better they would have done if the season had been favorable, you would have to guess?

MR. SMITH.— No; the point we cannot tell is what those cows would have done with hand milking.

Question.— Have you ever tested the fat contents of the milk?

MR. SMITH.— It has run just about the same as previously with hand milking.

Question.— Do the cows take kindly to the machine?

MR. SMITH.— In our experience the cows usually take very kindly to the machine.

MR. DAWLEY.— There are no serious disturbances?

MR. SMITH.— No.

MR. FULLER.— In reaching your conclusions you are comparing your machine with a good milker?

MR. SMITH.— Yes, a fairly good milker.

MR. DAWLEY.— Do you find where a cow doesn't take kindly to the machine at first that you can bring her to it or does she continue to dislike it?

Mr. SMITH.— These cows we have had to manipulate the most, do not improve a great deal. I can say this, if I were going to have the ideal conditions for the use of the machine, I would want to begin with heifers. The heifers milk all right.

Mr. FULLER.— In some cases I have had inquiries from men who are not of a mechanical turn of mind.

Mr. SMITH.— The work of the milking machine depends on the man very largely. Our experience would indicate that it will succeed with a good man, and it will not succeed with a poor man. There are a few things that are very important in the running of the milking machine. When you get the machine you have different sized teat cups for cows with different sized teats, running from 0 up to 5. If you put a teat cup on a cow which is too large, after she has milked a little it begins to hurt her and it will stop the flow. It is very necessary that the man who is operating the machine pay careful attention to the selection of teat cups to fit the cow. The milking machine will not succeed when careless slip-shop methods prevail. It requires a man that has a knowledge of cows, together with quite a little mechanical ability, knows what cleanliness means, in fact is thorough in everything he does, to make a success in running the milking machine.

Mr. STEVENS.—Are you now satisfied with the milking machine from a mechanical standpoint; that it will milk the cows?

Mr. SMITH.— So far as our experience goes from the time we have been using it, it is a success; it milks our cows satisfactorily.

Mr. FULLER.— How long a time does it take to milk the cows?

Mr. SMITH.—A man with two machines will milk twenty cows an hour, providing he doesn't have to weigh the milk and doesn't have to carry his milk a great distance. If he has to weigh his milk and has a distance to carry the milk it makes a marked difference.

Mr. FULLER.— That includes after milking by hand?

Mr. SMITH.— Yes.

Mr. FULLER.— Is it practical for a man to run more than two machines?

Mr. SMITH.—A man who is an expert can run three machines.

Mr. DAWLEY.— I was at a place where a man was milking forty-five cows with three machines in an hour and three-quarters.

Mr. SMITH.—A man can run three machines and do it well if he is quick and knows how to do things. If his milk had to be carried any great distance it would be well to have some one to take care of that part of it and do the stripping.

Mr. FULLER.— How about the ability to get hired men to run them?

Mr. SMITH.— I do not know about that. That is a question.

Mr. WARD.— Would there be any injurious effects from using a machine on a cow after she is milked thoroughly clean?

Mr. SMITH.— The cow doesn't seem to mind it. There is an observation glass on the machine so that you can see at a glance when she has ceased milking. A man calculates to get there a little bit before the milk stops in order to manipulate the udder.

Mr. WARD.—Are there any bad effects when one cow is working and the other isn't?

Mr. SMITH.— We haven't seen any bad effects. You can cut one cow off if you wish to, if there is a marked difference. If you have too large a teat cup there might be a hardening of the teat and sometimes the udder. If there is a hardening of the udder and the man knows his business, he wouldn't use the machine on the cow.

Mr. WARD.— Do you expect as much improvement in this machine in the future as in the last year or two, so it would pay one to wait?

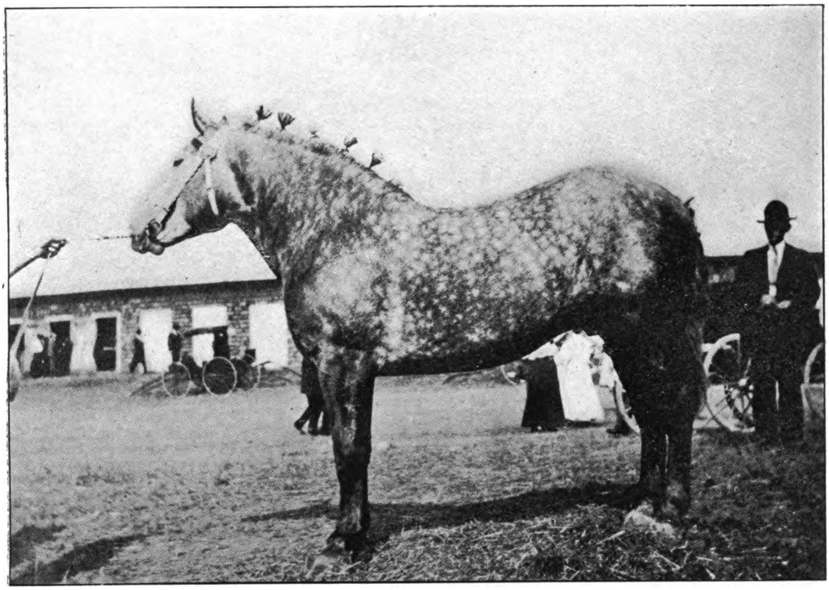
Mr. SMITH.— I do not; with the new machine I doubt whether there will be many more improvements. I do not see where there is anything else that requires a change.

Mr. DAWLEY.— Haven't the manufacturers said that the machines put out from now on would be practically the same?

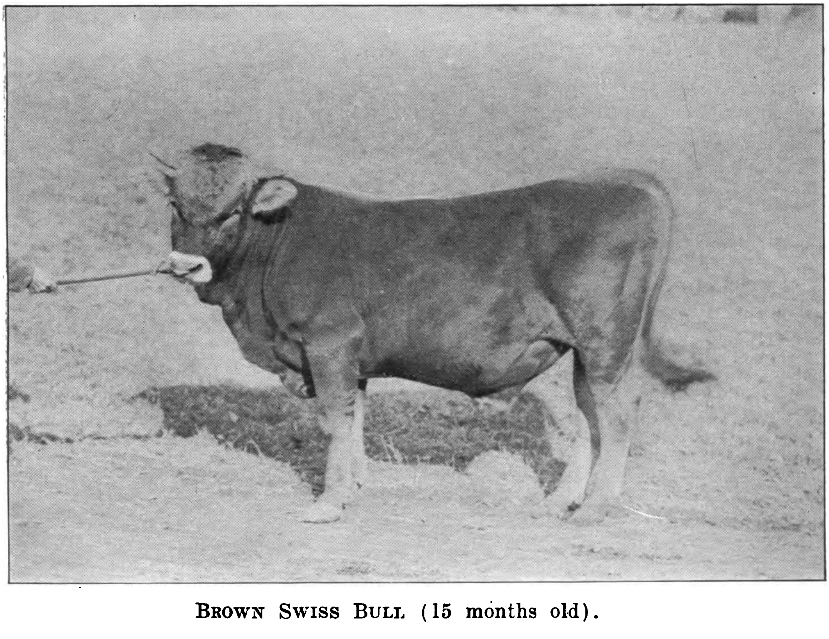
Mr. SMITH.— Yes.

Mr. WARD.— How about washing the machine?

Mr. SMITH.— It isn't at all difficult to wash. As soon as the men get through the milking they attach the machine to the vacuum pipes near a cold water faucet at the end of the stable; pump cold water through the teat cups, rinsing them out thoroughly; then pump hot salsoda water through them, rinse them again with hot water, after which the cups are taken off



Percheron Stallion.



Brown Swiss Bull (15 months old).

and placed in a 10 per cent. solution of brine. This is done both night and morning, and after the cups are placed in brine in the morning the pail and pulsator head are taken to the dairy room where they are thoroughly washed and steamed. All the rubber parts are washed once a week and thoroughly cleansed by brushing with salsoda water and hot water.

MR. WARD.— What does that machine cost?

MR. SMITH.— This machine costs $90 with these rubber teat cups; I think there are three sets of teat cups.

MR. LYON.— How long will the rubbers last?

MR. SMITH.— We have used the rubbers all summer, and I don't see as they are changed any. The apron gets weak after a while and has to be renewed.

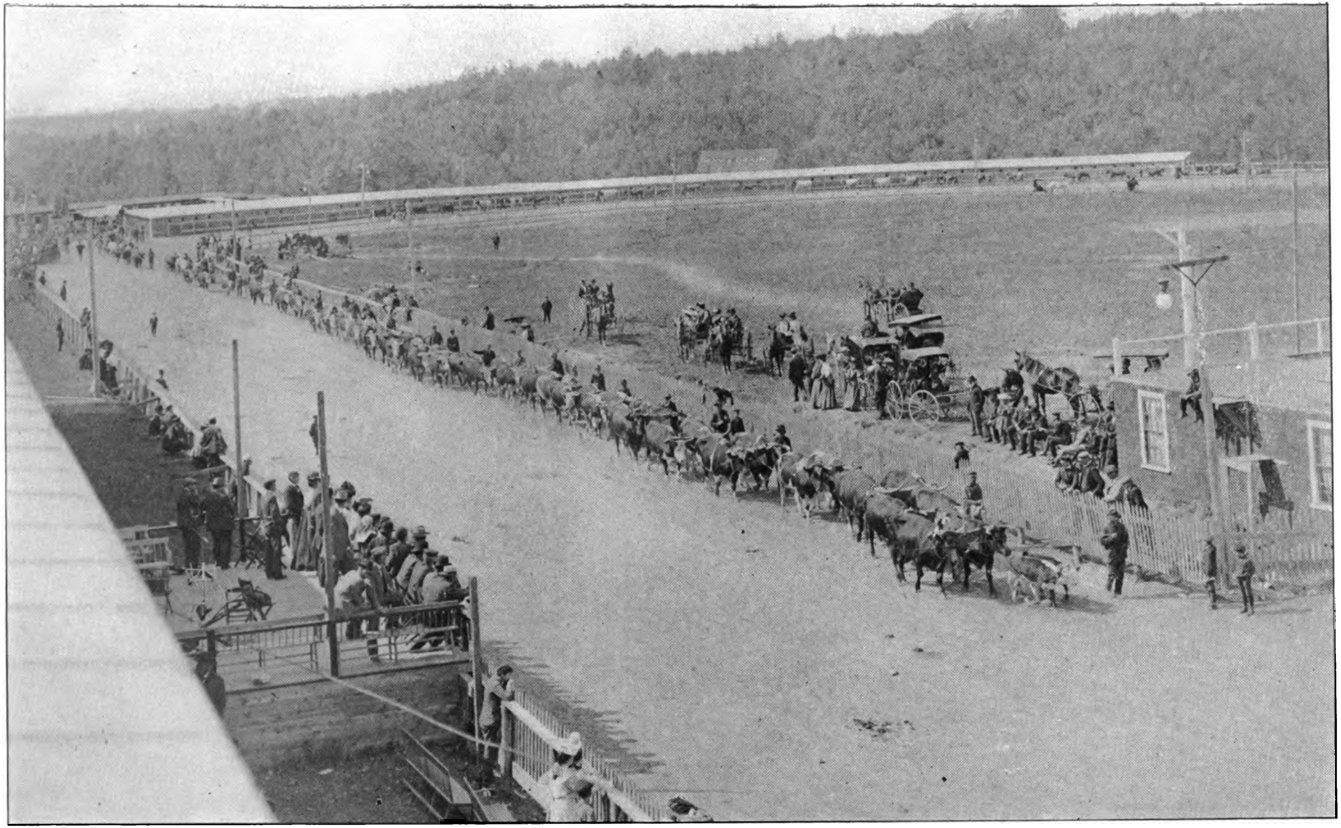
SANITARY MILK.

By H. A. HARDING, State Experiment Station.

Professor Pearson spoke of the use of this score card, and I think it might be a good thing to point out some of the results we have had by the use of this card in connection with the milk supply of the city of Geneva. It seemed that the first thing to do was to find out what sort of milk, or under what conditions our city supply of milk was being produced. The first thing to get at is what are the real facts in the case. I believe there is no more convenient method of putting the facts in shape for comparison than by means of this score card. You get a mass of data relating to fifty or one hundred dairies before you, and it dazes you rather than clears the situation when you see it in detail, but when you get the data upon a numerical basis, and can see that one man stands seventy-three and another seventy-four, etc., it assists you to get a notion of the relation of things.

We went through forty dairies with this score card. We had the usual luck with those things, for, thanks to a Civil Service Commission, we drew a Lehigh baggagemaster as an inspector, a man who had not been on the farm for ten or fifteen years. I thought that we were defeated, but after talking it over with Mr. Pearson, we concluded that if we got out a system of questions the baggagemaster could fill them out properly, so in practice the thing worked out rather better than you would have expected.

Then, the next subject Mr. Pearson spoke about was getting the data from that inspector and reducing it to a numerical basis. I struggled with this for some time, but I will say that the inspector now has a more definite notion of what we want. It is a thing which is in its infancy and will improve with use. As I have seen a goodly number of these dairies personally, I was in-



Parade of Live Stock at a State Fair.

terested in the comparison between the numerical results and my own impressions. There is a good deal of merit in this thing. It is progress along right lines.

As to results with those forty dairies, we had two good, twenty-three medium, fifteen poor. That is the situation at Geneva. That does not exactly express the thing the way it ought, because the bulk of them did not differ very widely. Starting in pretty well up in the medium class, they are about the same until you get down toward the poor, where the numbers get thicker, and one-third will lie in close to the turning point between medium and poor. I trust a year hence they will move up the line. A lot of these things which would make better milk can be done almost without expense; it is just a matter of care and doing the thing right.

One of the dairies I personally observed totals up 398, that is, it is at the turning point between poor and medium. If I describe it in a word, it will give a notion of the character of those between medium and poor. It was a large barn, built perhaps fifteen years ago. The farm, unfortunately, had been rented most of the time since then, and not kept abreast of the times.

There was a basement under the whole barn and heavy timbers on the top with the many years' accumulation of cob-webs, etc. The lighting was poor, little windows, 8x10-inch, two or three of them scattered along here and there, no particular partitions, horses in one end, cattle barn in the middle, and grain bins toward the end. There had been a good floor but it had gradually disappeared. I think we gave a stable rating of two. The cattle, running in pasture, they came in and were milked. That was all there was about it. There was nothing especially bad about it. That represents about where the line breaks between poor and medium in classification. We didn't want them all on the poor line. We wanted to string them out a little bit, and, at the same time, to stimulate others to come up to it. It is a thing which the farmer can accomplish without any particular expense in starting on the production of better and cleaner milk. Those cob-webs can be taken down this winter. He can get rid of those and a good many things can be done toward the production of better milk without expense. So much for the way the score card has worked with us. It seems to me, after all, it is difficult to reach the two things which are most important in the production of better milk. We want first a healthy cow, and then we want the milk handled by healthy people. In addition to that, we want to keep the milk free from contamination. This latter point is handled by the score card. The health of the people is one of the most particular points in the production of milk, and one of the most difficult things to handle. Where there are cases of measles in the family, it is a difficult thing to get at it.

Question.— Couldn't those cases be reported by the physician?

Mr. HARDING.— Theoretically, yes; but if a physician, whose practice is not as large as he would like to have it, is called out in the case of the family of one of the attendants in a dairy, he is a little tender about reporting a condition which may put that man out of commission a considerable length of time. They are a little tender about that.

What I want to talk to you about principally is our work with the milking machine. This question is going to come up pretty often this winter. You will get as many questions on this as anything else. Mr. Smith will speak to you about the parts of the machine and its practical manipulation and the time required, and I will simply speak of the effect of the germ content.

The germ content has been found to be a convenient and practical indicator of the care and cleanliness exercised in the production and handling of milk.

Classes of milk.— Milk may be divided into three classes with regard to the general care exercised in its production — cheese and butter factory milk, city supply milk and certified milk.

The cleanliness of milk for butter and cheese factories is rarely tested further than to require that no pronounced changes be evident in the milk.

City supply milk is coming to be subject to an inspection as to the conditions under which it is produced, is sometimes tested as to its germ content, and, in a few cities, is required to have less than a certain number of germs per cubic centimeter.

Certified milk is required to be produced under good conditions, is subject to constant inspection and is required to have less than 10,000 germs per c.c. at the time that it is placed upon the market.

Machine used.— The work this year has been entirely with the Burrell-Lawrence-Kennedy machine. We have operated this machine in accordance with the directions sent out by the manufacturer for the guidance of the dairymen, except when it was necessary to slightly modify them in testing the influence of the different steps.

Thus far in our work with the milking machine, we have attempted to handle it under conditions which would be comparable with those to be expected in the production of a good grade of city milk.

Last year in working with a Globe milking machine, we found an average germ content of thirty-nine samples to be 800,000 per c.c. The tubes through which the milk passed in the Globe machine were nearly identical with those in the Burrell-Lawrence-Kennedy machine. Tests of forty-nine samples taken from the Burrell-Lawrence-Kennedy machine, when it was handled in a manner quite comparable to the handling of the Globe machine, except that the milking tubes were immersed in a salt solution between milkings, gave an average germ content of 31,600 per c.c. The major portion of this difference may be safely ascribed to the action of the brine. Closer comparisons, using the same machine with and without the use of brine, will be made later.

The Burrell-Lawrence-Kennedy machines are provided with attachments so that the air entering the machine may pass for the most part through cotton filters.

As has been already stated, an average of forty-nine tests in which the tubes were held in brine between milkings, but the filters were not used, was 31,600 per c.c.

Under similar conditions, except that the cotton filters were in place during the milking, an average of forty-eight tests was 14,500 per c.c. The use of these filters had practically reduced the germ content one-half.

At the time that the milking of any pair of cows is ended the air in the pail is partially exhausted and this air must be replaced before the pail can be opened. The handiest way to admit the air is by disconnecting from the stanchion cock, since this must be done in order to remove the pail to the next pair of cows.

An average of fifty-eight tests, in which the brine and cotton filters were used and in which the vacuum was broken above the pail, was 13,900 per c.c.

Where at the end of the milking the air was allowed to flow in through the teat cups, an average of twenty tests was 4,270 per c.c. All but two of the twenty milkings had a germ content less than 10,000 per c.c., and accordingly conformed in this particular to the present standard for the highest grade or certified milk. These two milkings contained 11,140 and 15,360 per c.c., respectively. It should not be forgotten that we have hardly made a beginning in the knowledge of the proper conditions for running a milking machine. Such being the case, the outlook for finally obtaining a clean and satisfactory product at a reasonable cost, through the use of the milking machine, is certainly favorable.

Mr. VAN SLYKE.— What is the strength of the brine solution ?

Mr. SMITH.— It is a quart of salt to ten quarts of water.

Mr. VAN SLYKE.— How often is the cotton placed in the machine?

Mr. HARDING.— At each milking. There is some little expense, but cotton is very cheap, after all. Since the syllabus was gotten out, we have run the machine to find out what the difference is in the effect of using ordinary cotton and absorbent cotton and we find there is apparently no difference. For all practical purposes, I think there is no difference between one cotton and the other.

To sum it up, the question will be, "They can get these results there; can we get them in other places?" Mr. Ferguson scored our dairy while he was there. He put our dairy down as ranking "good" on the same basis used in scoring the dairies furnishing milk to Geneva. We run this machine during these tests in accordance with the Burrell people, except that we use the cotton and things of that kind. It does seem that the results we got there could be duplicated in any good dairy. These determinings were made on the first pair of cows milked in each case. We have been taking the milk from the next pair of cows and they seem to work out just the same. These records are all taken right along, we haven't skipped any, except in one or two cases where the teat cups dropped on the floor, but aside from that they are the straight results as we got them night after night. It does seem as though the milking machine from a health point of view in milking cows is very satisfactory. It seems to me as though the bacterial side of it could be taken care of. I believe we can get low bacteria content milk with the milking machine run properly, with less expense than the same grade of milk hand milked.

Little-Peach.

By L. B. Judson, State College of Agriculture.

Symptoms.— 1. Just back of healthy green leaves at the tips of the branches are seen leaves of a sickly yellowish green tint, usually curling somewhat backward, and clustering closely about the twigs. The yellow tinge is commonly diffused, rather than mosaic in pattern.

2. Belated fruit, remaining small and green after other fruit has swollen and colored, often clings to the tree till leaves fall, or later.

Little Peach is sometimes attributed to trees suffering simply from:

1. Starvation and drought.
2. Insects, like the borer and scale.
3. Lack of drainage.

Treatment.— Eradication alone is effective. Pull up and burn affected trees as soon as discovered, and thus prevent spread of the malady. A healthy tree may be planted in the same place without danger of infection from the soil.

Cause.— Repeated experiments have failed to reveal the presence of any fungi or bacteria. The disease is infectious, though it has never been spread artificially, except by the introduction of living tissue into the host.

Control by Eradication: Results at Youngstown, N. Y.

Year.	Number trees inspected.	Number diseased.	Per cent. diseased.
1906	60,972	1,506	2.47
1907	33,911	481	1.4

All the orchards inspected in 1906 were gone through in 1907, but many trees have been destroyed by winter-killing, hence the much smaller number of trees inspected in 1907.

Midway at a State Fair, Showing Flower Garden.

Dipping of Nursery Stock.

By P. J. PARROTT, State Experiment Station.

With the appearance of the San José scale as a nursery and orchard pest, some system of control of nursery stock was imperative. To this end, nursery inspection laws, designed principally to prevent the distribution of the scale by the trade and to protect purchasers, were enacted in many states. These statutes, providing for the proper inspection and certification of nursery stock, and the growing demand for clean and reliable plants, have awakened nurserymen generally to the necessity of meeting the new conditions. To prevent the distribution of the scale through shipments of stock, fumigation with hydrocyanic acid gas was put into practice with the passage of the inspection and is now employed by many nurseries. It is one of the most efficient remedies for certain species of scale insects and is especially adapted to the treatment of nursery stock.

DIPPING, A PROPOSED SUBSTITUTE FOR FUMIGATION.

Efficient as is fumigation, it is not without certain objectionable features. The principal complaints against its use are that it is dangerous and that uncertain results on scale and plants may attend the treatment. For these reasons principally, dipping in the lime-sulphur wash has been proposed as a substitute for fumigation. The advantages claimed for this method are that it is more convenient than fumigation, and that it is fully as safe and efficient. Dipping of nursery trees in a contact spray has not been extensively practiced and present interest in this process is the result of the new law in Oregon, which compels that all buds, scions, nursery trees, etc., sold in the state shall first be dipped in a standard solution of the lime, sulphur and salt wash.

Opinions vary as to the merits of dipping for the purposes intended. For these reasons, further investigation to determine the efficiency and limits of safety of dipping were desirable. In this inquiry, efforts were largely directed along two lines, to determine

(1) the effects of the treatment on the scale, and (2) the effects of the treatment on the trees. The details and results of the various experiments are briefly as follows:

Experiment I. Wash at Different Temperatures.

Temperatures, 60°, 100°, 120° and 212° Fahr. Number of trees dipped, 120 Ben Davis apples, all infested. Treatment, dipping in standard lime-sulphur wash.

Results: Lot dipped in wash heated to 212° Fahr. entirely free of scale. The effects of other treatments on scale, variable.

Experiment II. Dipping at Different Time Periods.

Time periods, instantaneous immersion and dipping for one, two, three, five and ten-minute periods. Trees, 180 infested Ben Davis apples. Temperature of wash, 60° Fahr.

Results: The effects of treatment on scale were variable.

Experiment III. Dipping at Different Time Periods.

Same as Experiment II with 180 three-year-old Bartlett pears.

Results: Same as Experiment II.

Experiment IV. Dipping in Various Sprays vs. Fumigation.

Treatments, instantaneous immersion in sulphur wash; kerosene emulsion, 10%, 15% and 20% oil; and scalecide, 5%, 6⅔% and 10%. Temperature of mixtures, 60° Fahr. Number of trees, 296 Ben Davis apples. Fumigation, one hour with .3 gram of potassium cyanide per cu. ft.

Results: Fumigation completely destroyed scale. Kerosene emulsion, 15% and 20% oil, and scalecide 6⅔% and 10%, proved very efficient but did not entirely prevent breeding of the scale.

Experiment V. Wash at Different Temperatures.

Temperatures, 60°, 100°, 120° and 212° Fahr. Number of trees dipped, 120, one-half of which had tops only immersed. Variety, Ben Davis. Treatment, dipping in sulphur wash.

Results: Of 60 trees with roots dipped, 57 were killed. Trees dipped in boiling wash had tops much injured. Dipping tops only in wash at other temperatures caused no injury.

Experiment VI. Dipping at Different Time Periods.

Time periods, instantaneous immersion and dipping for one, two, three, five and ten minutes. Trees, 180 Ben Davis apples. Temperature of wash, 60° Fahr.

Results: Trees with roots dipped in sulphur wash were invariably killed. Slight injuries to tops by prolonged immersion.

Experiment VII. Dipping in Various Sprays vs. Fumigation.

Conditions as in Experiment IV.

Results: No injuries by fumigation or dipping in kerosene emulsion or scalecide. Practically all trees with roots dipped in sulphur wash were killed.

Experiments VIII, IX, X, XI, and XII. Dipping at Different Time Periods.

Experiments with 120 two-year old Bartlett pears, 290 three-year-old Mann apples, 290 three-year-old Bartlett pears, 290 three-year-old Satsuma plums, and 300 three-year-old Fitzgerald peaches, respectively. Treatment, dipping in sulphur wash. Time periods, instantaneous immersion and dipping from one to ten minutes.

Results: Mann apples and Bartlett pears were not so badly injured as Ben Davis apples, by having roots in contact with the wash. Plums with roots immersed were killed. Peaches were completely ruined by the treatment of the roots, and tops were injured by immersion for five to ten minutes.

CONCLUSION.

Dipping of roots of plants in the lime-sulphur wash may be attended with injuries. Results on scale by this treatment are variable, depending on amount of infestation and the extent of the coating of the wash on the trees. For dipping purposes, kerosene emulsion and miscible oils appear to be the more promising sprays. Until the circumstances and conditions by which they may be satisfactorily employed are determined, their use should be largely tentative. Fumigation with hydrocyanic acid gas is the most efficient treatment for nursery stock.

Rural School Education.

By A. Ross Hill, Cornell University.

The function of the school as a human institution must be regarded from two points of view, that of the society which supports the school and which the pupil is supposed to serve after his training has equipped him for social service; and that of the child whose personality is to be developed, and whose life is to be enriched through the agency of the school. Society demands that the school shall train the child into those habits of industry, accuracy, carefulness, responsibility and initiative which will make him a self-dependent member of society, and give him such insight into social institutions, industrial, commercial, political and educational, and such a command of the tools of social intercourse that he can not only maintain himself and his family, but share the burdens and contribute to the progress of society as well. The child demands of the school that it provide him with an environment that is not alien to his native impulses and interests, but allows scope for the display of his expanding functions and gives meaning to and enriches his growing experience.

On the side of the social demands, the school must adjust itself to changes in social life from age to age. The elementary school, as we know it to-day, is one outcome of the Reformation movement in Europe, with its religious motives and desire that all should learn to read the word of God for themselves. Reading and along with it spelling and writing thus came to take a prominent place in the work of the elementary schools. Later, the development of commercial life demanded that arithmetic be taught, especially with reference to the sorts of commercial operations then practiced in society. Our colonial schools were the direct outgrowth of the Reformation movement, colored somewhat by the industrial and commercial life of early colonial times. Until recently our elementary schools have clung, and I fear to some extent our rural schools still cling, to the curriculum that was

ADMINISTRATION BUILDING AT A STATE FAIR.

prescribed to meet those earlier conditions in our civilization. But not only was the school training of that time more directly planned to meet social conditions; the household and neighborhood systems of industry were admirably adapted to give every child in the community a share in the social responsibility and achievement. If the school failed, as in a measure it did, to give adequate training for future citizenship, the home and neighborhood experiences gave an education that was vital and a training in industry and initiative that was unsurpassed.

But the factory system and the application of machinery to every form of industry have robbed the child, even the child in the open country, of much that formerly contributed to his real and vital, if informal, education. The school must now seek to discover the means of restoring to the child, while retaining the advantages of modern life, something that will take the place of his former home occupations with their exaction of personal responsibility and their training in relation to the physical realities of life. I believe that in a blind sort of way it is the feeling of this need which is prompting the directors and principals of schools to introduce manual training and the household arts into the curriculum of our city schools, and similar reasons point to the importance of readjusting the work of our rural schools to meet the changed situation in our rural social economy. In the rural schools of to-day "the motive and the cement of social organization are alike wanting." The school is attempting to prepare future members of society in a medium in which the fundamental conditions of the social spirit are almost entirely wanting. It places the whole emphasis upon learning in an individualistic fashion. For one child to help another has become a school crime. All opportunity for interchange of ideas and mutual helpfulness which forms the very basis of our social life is denied, and it is little wonder that the school fails to hold the pupil voluntarily, or that the community feels the hollowness and abstractness of the school's work. Instead of giving a real education, the rural school is devoting its energies to training in the so-called school arts, reading, spelling, writing and arithmetic, which are only the tools, in fact only some of the tools, of our rural social life. Most communities fail to supply the needs referred to above, of giving the pupil an insight into and appreciation of the problems of rural life, in their setting with relation to the life of larger social units, and ability to act upon these problems in an intelligent and progressive fashion.

Some have hoped to improve the schools by the introduction of new subjects, such as drawing, music and especially elementary agriculture. This attempt at enrichment may or may not help, but it cannot greatly enhance the value of the work done in rural schools to add a few subjects to be taught after much the same fashion as the old subjects. It will increase the teacher's burden and multiply tasks for the pupil without greatly changing the spirit or the vitality of the work as a whole. What seems to be needed is a redirection of the whole work of the school, by supplying some center of interest for all its problems and some motive for all effort on the part of the pupils. It seems to me self-evident that this center of correlation must be found in the activities and occupations of the community. For the rural school this will mean that farm life must be made the center around which instruction should be grouped, from which it should branch out to the larger human interests of state and national life, and in reference to which the school arts themselves (reading, spelling, writing and arithmetic) should find their motive and their function.

When we turn to a consideration of the child himself, we find equally potent reasons for a change in the spirit and character of school work. As mentioned above, the typical school discipline, method and curriculum treat the child as essentially a learner of, an absorber of information, a creature who needs no motive for work but who must with docility accept the tasks assigned by an institution that seems to him no essential part of his life. The center of gravity is outside the child, and the school never becomes the place where he actually lives. He lives, moves, and has his being in the world of outside realities. He seeks them at every opportunity, by vacation, recess, playing sick in order to stay away from school, by truancy and by living with them in his imagination when he is supposed to be at his school work. To correct this situation, we are told that the teacher should cease the pouring-in process in education, and should strive to draw out the latent interests of the child. But the drawing-out process is hardly necessary; the child is "already running over, spilling over with activities of all kinds" and the question of education is the question of taking hold of his activities and giving them direction.

The social instincts of the child, as shown in conversation and imitation, may be utilized in the teaching of language which is the simplest form of the social expression of the child. Language is the means by which the child gives his experience to others and gets theirs in return. Think, therefore, of the absurdity of having to teach language as a thing by itself! Before the child goes to school he delights to talk of the things that interest him. But when there are no vital interests appealed to, it is not surprising that one of the chief difficulties of school work has come to be instruction in the mother tongue. There is a great difference between having something to say and having to say something. The constructive instincts may be utilized in teaching the elements of number, in developing an appreciation of artistic forms, in giving a knowledge of the qualities of materials used; and in description of processes gone through and work done it combines with the social instincts in promoting an accurate, clear and definite use of the mother tongue. The interests in nature combine with the social and constructive instincts in demanding on behalf of the child that the rural school be so organized and its point of view so revised that school life shall be an epitome of the whole life of the rural community, and that the instruction and discipline be thus made vital and significant.

The rural school of the future will have its roots in agricultural activities, its trunk in human life at large and its fruitage in rural citizenship with initiative, intelligence and social solidarity. To help in speeding the time of its arrival and in working out its problems in detail should now be the joint work of the College of Agriculture and the School of Education of Cornell University.

Training at the New State School of Agriculture, at St. Lawrence University.

By K. C. Davis, State School of Agriculture, St. Lawrence University.

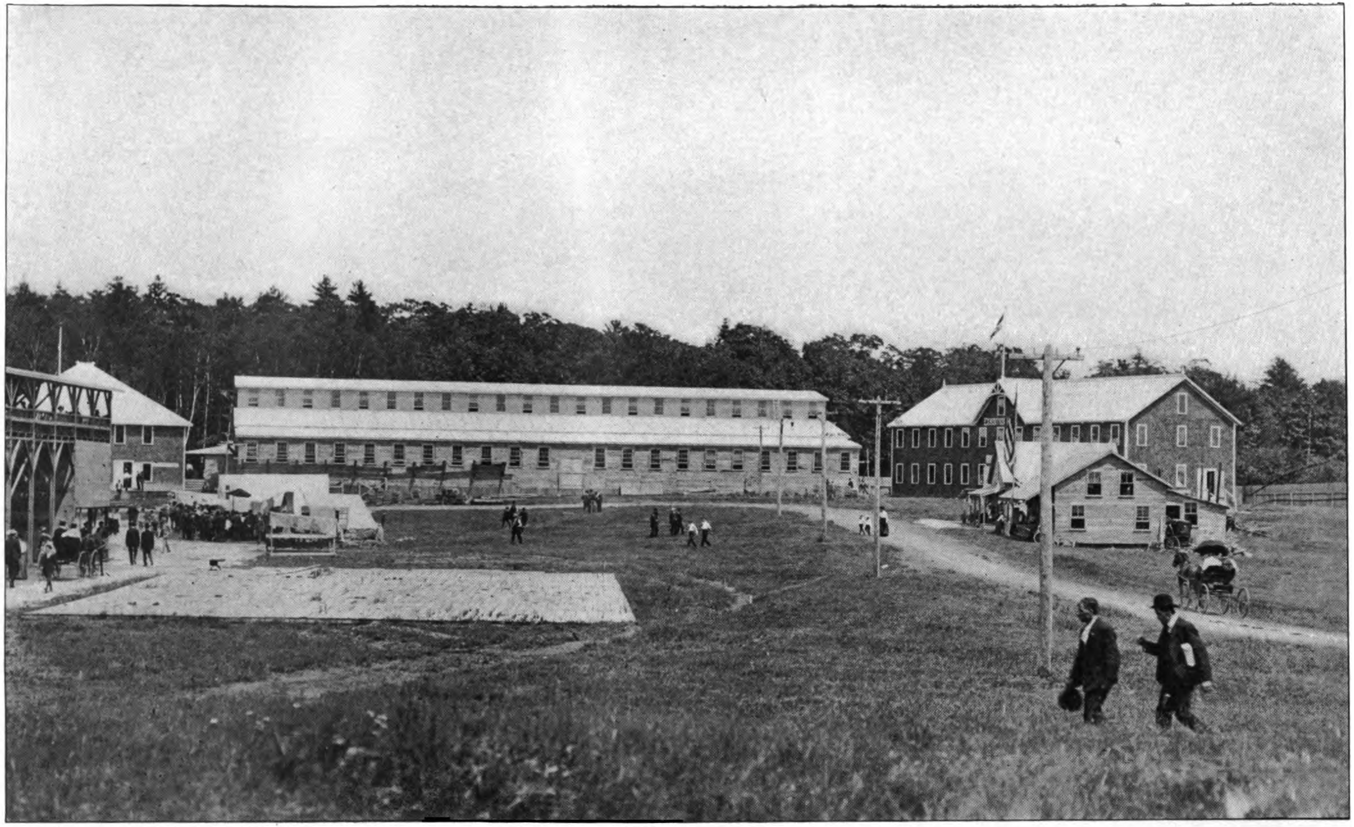
Schools of agriculture of high school rank are a new feature in the American free school system.

There are several types of these schools, but the new school here is a state institution built and supported by New York State.

Science and practice go hand in hand in the modern up-to-date farming. The farmer boys of to-day have as good a right to a practical agricultural education as the physician or lawyer has to a training along his line before he begins to practice his profession. A short course of two or three years at an agricultural school is of more value to a young man than ten or fifteen years of experience, much of which may be adverse experience and cause a great deal of loss to himself or those who are financiering his experiments.

Most of the people who are successful in America, at the present time, have received education somewhere. The more practical the education is which a young man or a young woman receives, the better it will pay in dollars and cents. The well-educated and well-trained farmer is constantly demonstrating to-day the great advantage he has over the uneducated and untrained farmer. Agriculture is coming to the forefront of the world's attention and throughout the country agriculture is experiencing a wonderfully intellectual uplift; it is such a forward movement as few other callings ever received and other ages witnessed. Only the educated farmer will have a chance in the sharp competition of the future, but he will live much better and make much more than the farmers have been making in the past.

The training to which I refer should be of such a character, and is of such a character in the new agricultural school, that



Coliseum and Main Hall at a State Fair.

the school does not resemble any other school you ever saw. The students learn by doing. The useful side of the knowledge and training given to students is emphasized. This is the principle on which the school is founded. At every point the school is made to co-operate with the farm, the shop, the dairy and the home.

The Agricultural School has several different departments. Some of these are:

1. Agriculture and horticulture.
2. The dairy department.
3. Animal husbandry.
4. Manual training.
5. Domestic science.
6. Scientific subjects.
7. Business subjects.
8. Academic branches.

In all these different departments practice is given on the farm, in the laboratories, in the shops and by trips to neighboring localities where valuable lessons may be learned. The agricultural and horticultural subjects may be considered to include soils and fertilizers, economic plants, the study of injurious and beneficial insects, diseases of plants, spraying to combat diseases and insects, market gardening, fruit raising, corn and grain studies.

Animal husbandry includes stock judging, breeds and breeding, feeds and feeding, care of animals, diseases of animals, animal physiology, poultry raising and herd management.

The dairy department work includes butter and cheese-making, testing for butter fat, care of milk and cream, testing for acid, water, etc., use of culture and bacteria, rules and laws.

The farmer should be a good business man. Many farmers of the present time are not well up in business methods. The school will give training in farm management, farm economy, commercial law, business forms, and farm arithmetic.

The value to the farmer of mechanical training is apparent on every hand. It enables him to handle his machinery and tools and to perform all of his work with greater accuracy and precision. To train the farmer along these lines the subjects given him are farm carpentry, farm blacksmithing, assembling new machinery, care of farm implements, planning farm buildings, and farm mechanics.

The farmer's wife and daughters ought to be something more than mere machines. Too many of them grind out their daily tasks, calling them drudgery and hating them with all their strength, year in and year out. They should study many things their brothers study and others that their brothers do not study. This broadens their views of housework and farm life. The possibilities of their lives are opened up and a way to better, purer lives is shown them. Training is offered in cooking, chemistry of foods, home nursing, emergencies, home management, laundering, domestic hygiene, sewing and other special subjects for women.

The village of Canton, N. Y., has been chosen as the site for the new State School of Agriculture, which is a department of St. Lawrence University. Canton is a beautiful village, with churches and good homes, where students will find a wholesome environment. The university spirit pervades the atmosphere, and education is looked upon with credit by all citizens. It is the county seat of the largest county in the state and is only eighteen miles from the St. Lawrence River. The surrounding country is a good farming region.

The main building of the new State School of Agriculture is not to be completed until next spring, but the school has opened in temporary quarters, with a small class of young men who have enrolled for the regular course of two years. Classes are held in the farmhouse, which is fitted up with schoolrooms and laboratories. Several classes, however, use the university laboratories in Carnegie Hall. The class in land draining has been making good application of the knowledge gained, by attending to the surveying, location and laying of tile for the drains of the university farm. The present class in stock judging and study of breeds is conducted by Dr. J. M. Payson who spent last year at the Cornell College of Agriculture. This class is taken to nearby herds of pure-bred stock for exercise in judging and for study. It is hoped that some stock may be kept at the university farm for this and other purposes in the near future.

The classes in farm arithmetic and farm bookkeeping are instructed by Prof. M. L. Fuller. Every problem handled in the subject deals with the farmer's conditions right here in this state. The rainfall required for certain crops, the income of all fields, the cost of filling silos, the expense of harvesting, storing and marketing certain crops — these and hundreds of other problems are worked out by this class. The simplest forms are used for farm accounting.

The university farm is slightly rolling and has a diversity of soils. This farm adjoins the large campus on the south. The new school building is thus located in the group of college buildings and yet immediately adjacent to the farm which the school will use. Farm machinery is being provided. A fine farm team of grade Clydes is owned by the school. Students will have the benefits of the most modern farm practices and management. There is a good supply of reference books, text-books, charts and other apparatus for the use of classes.

The tuition at this State School of Agriculture is free, of course, to all, only small fees being charged for text-books, laboratories, etc. Pupils are received at this school from the common schools of the country and villages.

Circulars of information and free bulletins are published quarterly by the new school.

Spraying for the San José Scale in Old Apple Orchards.

By P. J. Parrott, State Experiment Station.

In general, our fruit growers, by the faithful observance of the details required for the proper preparation and application of known remedies, experience no especial difficulty in controlling the scale on small trees. In many localities, while there is a full appreciation of its destructive capacity and the danger of neglecting to afford suitable treatment to the trees, the scale is losing many of the terrors which it formerly inspired; and annual spraying of peaches, plums, pears and apple trees of moderate size for this pest is now an established practice in the yearly routine work of many farms. Equally satisfactory and encouraging, although of relatively less occurrence, are the successful efforts of commercial fruit growers in various localities of this state in controlling the scale in large orchards of old apple trees. Unfortunately, in this latter endeavor, these results are exceptional. The average fruit grower has not been able to afford efficient protection to his old orchards and there is usually more or less spotting of his fruit, with varying injuries to the trees. It is not an infrequent complaint that spraying of old trees for the scale is impractical, as the operation is too costly; and despite the treatment it is impossible to produce marketable fruit.

To determine if there are practical methods of protecting commercial apple orchards and the cost of such treatment, the station is co-operating with a number of fruit growers to protect their orchards. It is intended to continue this co-operation until orchard practice for the treatment of the scale is thoroughly established throughout the state. The details, items of expense and the results of three of the experiments conducted in 1907 are briefly as follows:

NIAGARA COUNTY EXPERIMENT.

Orchard of A. H. Dutton, Youngstown, comprises twenty acres, consisting of 598 trees of at least forty-seven years of age. The scale was first discovered in 1900. Power spraying rigs were used. Items of expense for spraying orchard in 1907 are as follows:

Lime-Sulphur Wash.

Number of trees sprayed	298
Number of gallons of wash	3,900
1,170 pounds sulphur, at 2½c	$29.25
1,560 pounds lime, at 42c. per bu	9.36
Use of cooking plant and fuel	2.10
4 men for 3½ days, at $1.50	21.00
1 man for 3½ days, at $1.50, for cooking wash	5.25
2 teams for 3½ days, at $2.00	14.00
Wear on sprayer	9.80
Total	$90.76

Average number of gallons per tree	13
Cost of spray per gallon, including labor of making, supplies, fuel, etc.	$0.011
Average cost of spray per tree, including labor of making, supplies, etc.	.15
Average cost of labor and team for applying the wash.	.11½
Average cost of treatment per tree	.30½

Supplementary treatment, oil emulsion (20 per cent. oil):	
Average cost of treatment per tree	.12

Crude Oil Emulsion (20 *per cent. oil*).

Number of trees sprayed	149
Numebr of gallons of wash	1,650
330 gallons of oil, at 12c	$39.60
82½ pounds of fish oil soap, at 5¾c	4.74

5⅛ gallons carbolic acid, at 54c	$2.76
2 men for 3½ days, at $1.50	10.50
1 team for 3½ days, at $2.00	7.00
Wear on sprayer	4.90
Total	$69.50

Average number of gallons per tree	11
Cost of spray per gallon	$0.02⅕
Average cost of spray per tree	.31½
Average cost of labor and team per tree	.11
Average cost of treatment per tree	.46⅔

Supplementary Treatment, Oil Emulsion (16 *per cent. oil*).

Average cost of treatment per tree	$0.12

Miscible Oil (10 *per cent.*).

Number of trees sprayed	116
Number of gallons of spray	1,100

110 gallons of miscible oil, at 54⅓c., including freight (20 per cent. discount)	$48.76
2 men for 18 hours, at 15c	5.40
1 team for 18 hours, at 20c	3.60
Total	$57.76

Average numbers of gallons per tree	9½

Cost of spray per gallon	$0.04⅖
Average cost of spray per tree	.42
Average cost of labor and team per tree	.07¾
Average cost of treatment per tree	.49¾

Supplementary Treatment, Miscible Oil (10 *per cent.*).

Average cost of treatment per tree	$0.20⅓

The average quantity of spray and cost of treatment per tree in these experiments, not including interest on investment and wear of machinery, are as follows:

	No. of gals. per tree.	Cost of treatment per tree.
Sulphur wash, average for 1905–6–7......	14	$0.31
Sulphur wash, average for 1907...........	13	.27
Sulphur wash, followed with crude oil emulsion..............................	17	.38
Sulphur wash, followed with kerosene emulsion..............................	17	.38
Crude oil emulsion, 20 per cent. oil.........	11	.43
Crude oil emulsion, with supplementary treatment............................	15	.54
Miscible oil, 10 per cent., at 40c. per gallon..	10	.50
Miscible oil, 10 per cent., with supplementary treatment........................	13	.69
Miscible oil, 10 per cent., at 50c. per gallon..	10	.60
Miscible oil, 10 per cent., with supplementary.	13	.83
Crude oil	5	.58
Kerosene limoid wash, 25 per cent. oil......	15	.60

WESTCHESTER COUNTY EXPERIMENT.

Orchard of Floyd White, Yorktown, comprises 276 trees varying from thirty-three to fifty years of age. Trees have been infested since 1900. Hand power pump, without tower, used. Average expense and number of gallons of mixture used in spraying thirty-three-year-old trees with sulphur wash and miscible oil are as follows:

	No. of gals. per tree.	Cost of treatment per tree.
Sulphur wash	17	$0.66
Miscible oil, 10 per cent., at 40c per gallon..	9	.79
Miscible oil, 10 per cent., at 50c. per gallon..	9	.88

ONTARIO COUNTY EXPERIMENT.

Orchard of Experiment Station, Geneva, comprises sixteen acres, representing 504 trees of thirty to fifty-five years of age. Trees infested since 1902. Power spraying outfit used. Sulphur wash, oil emulsion and miscible oils were the sprays employed. Average number of gallons of mixtures used in spraying and the cost of treatment per tree are as follows:

	No. of gals. per tree.	Cost of treatment per tree.
Sulphur wash	21	$0.36
Sulphur wash, with oil emulsion	22	.38
Oil emulsion, 15 per cent. oil	8	.21
Miscible oil, 10 per cent., at 40c. per gallon.	13	.64
Miscible oil, 10 per cent., at 50c. per gallon.	13	.77

SUMMARY AND CONCLUSIONS.

In the experiments described, the results by the treatments have been very encouraging. With efficient labor and adequate spraying machinery no especial difficulty has been experienced in preventing important injuries and producing yields of fruit, which have, for the most part, been unspotted. Experience, derived from our own endeavors, and observations of the efforts of commercial fruit growers demonstrate, with increasing emphasis each year, that the control of the scale on old apple trees is practicable, and that efficient protection can be afforded at a relatively nominal expense, compared with the productions of a well-managed orchard. The above figures indicate that spraying for the scale in an old apple orchard necessitates an additional expense to the usual outlay for its care of approximately forty cents to fifty cents for each tree. The principal problem in the treatment of old apple orchards for the scale is largely one of mastering practical difficulties. The sprays that are recommended are the sulphur wash, home-made oil emulsions and proprietary miscible oils.

DISCUSSION.

MR. DAY.— Have you ever done any spraying with line and sulphur in the fall of the year?

Mr. PARROTT.— Yes, we have conducted quite a little work and practically ruined one plot of plums for the Maxwell Company where we sprayed with a lime and sulphur wash. Professor Jarvis, of Connecticut, informs me that he has had the same results in Connecticut. Mr. Jarvis says that fall applications of scalecide do not injure the trees in the same way that the lime and sulphur does. That remains to be determined. He won't realize the difference until he leaves some rows unsprayed, and notices the difference in the yield. It did not occur to us at the Geneva Station until we left unsprayed rows, and the difference appeared. If a man can spray in the spring it is better. I would advise farmers to get power apparatus, because it reduces the cost of labor.

Mr. WARD.— What is the limit of height for economically spraying old orchards?

Mr. PARROTT.— We sprayed trees thirty-five to forty feet high.

Mr. WARD.— Isn't it true the expense of spraying trees as high as that is a great deal more than spraying them lower?

Mr. PARROTT.— I have no doubt of that. It is the labor that costs in the treatment of old apple trees. We figure the cost of spraying old apple trees to be about forty cents per tree.

Cabbage Seed-Bed Problem.

By W. J. SCHOENE, State Experiment Station.

In many parts of this state, where cabbage is extensively grown, farmers experience difficulty in growing sufficient number of seedling plants for their use. This is due largely to the destructive work of flea-beetles and root-maggots. It is not an infrequent occurrence that growers, after preparing their seed-beds and sowing several times the amount of seed required to set the desired acreage, are forced, after all, to purchase their plants. It is customary in years when these insects are abundant to import plants from other states. Farmers dislike to use imported stock and are partial to their home-grown plants for two reasons, viz.: (1) Economy. Plants can be grown for ten to fifteen cents per thousand, while imported plants cost seventy-five cents to two dollars per thousand. Also home-grown plants are stronger and usually grow better, and do not have to be reset as much as imported plants. (2) Safety. By importing plants there is danger of introducing destructive diseases and insects, as many pests of the cabbage plant are present in the seed-bed.

FLEA-BEETLES AND MAGGOTS.

These insects are destructive to seed-beds as well as to field crops. The seedlings are especially susceptible to injury because of their small size at the time of attack. Flea-beetles injure the plant by chewing holes in the cotyledons, and cause severe injuries, especially when the plants at the time of attack are only from one to two inches high. Two species of flea-beetles have been found working in plant beds which are, the Turnip Flea-beetle, *Phyllotreta vittata* Fab. and the Smart-weed Flea-beetle, *Systena hudsonias* Forst. The former appears about May 15th and is the more destructive, often ruining early plantings. The latter appears a few days later and is not as numerous or injurious. The root maggot injures the plant by channeling in and about the roots, destroying the root system. As a result the plants are stunted, if not killed. The injury is apparent about a week or ten days after the appearance of the flea-beetles and is shown by the wilting of the plants. If injured plants are examined, white footless maggots will be found about the roots. Two species of maggots have been bred which are the Seed Corn Maggot, *Pegomya fusciceps* and the Cabbage Root Maggot, *Pegomya brassicae.*

In the communities where these insects are abundant, farmers resort to various methods to raise enough plants for their use.

The more common practices are to plant more and larger seed-beds, which are frequently sown at different dates and are variously located on the farm. For the flea-beetle, dust sprays such as tobacco dust and lime, and spraying with Bordeaux mixture have been tried with varying success. For the control of the maggot, treating the earth about plant beds with contact sprays and the employment of cloth screening have been tried with success in some instances but, as a rule, farmers have failed to afford efficient protection to their seed-beds.

EXPERIMENTS BY THE STATION.

Because of the numerous failures on the part of farmers to grow sufficient seedling plants, the station has for the past several years been conducting some experiments in the growing of plants, in order to test the effectiveness of some of the well-known remedies. Considerable information has been collected regarding the value of the more promising measures. Crude carbolic acid emulsion, used at double strength and applied to the earth at frequent intervals, gave protection to the plants. The employment of tobacco dust about the roots of plants infested with maggots was the means of saving some badly injured plants. Kerosene emulsion and other remedies gave good results. In brief, most of the remedies tested afforded protection to the plants when applied properly and at frequent intervals. However, the work in general indicates that these methods of treatment are not suited to farm conditions, as the cabbage grower prefers to take chances on raising seedlings by making additional plantings rather than the application of insecticides. In view of the reluctance of farmers to employ spray mixtures, it seemed desirable to ascertain some other means of protecting the seed bed. The two most promising methods of growing plants are, (1) covering the plant beds with cloth screening and (2) growing the plants either before or after the flies have oviposited.

Experiments were planned (1) to obtain data regarding the possibility of evading important injuries by early or late plantings and (2) to test the efficiency and practicability of growing cabbage seedlings under canvas.

It has frequently been observed that cabbage seedlings planted at late dates were not injured by flea-beetles and maggots. To determine the value of this practice, plantings were made April 29th, May 13th, 17th and 29th. The conditions of the seedlings as regards insect injury were respectively as follows:

The sowings made April 29th appeared above ground May 13th and 15th, when the flea-beetles were present in large numbers. In spite of spraying four times with Bordeaux mixture, these plants were very much injured. The entire sowing was practically ruined by the work of the flea-beetles and maggots. The plantings made May 13th were not appreciably injured by flea-beetles but were seriously injured by the maggots. The last plantings, made on May 28th, were not injured by either flea-beetles or maggots. However, the sowings on the latter date did not produce large enough seedlings for transplanting. This seemed to be due to soil conditions, as a number of farmers in the same community started seedling beds on the same date and raised plants of the desired size in season for field planting.

To test the feasibility of growing plants under canvas, a seed bed was prepared May 13th and the seed was sown in 47 rows of 150 feet in length. The plants appeared on May 20th. On this date 21 rows were covered with canvas, the other 26 rows being kept as checks. In covering the plants, a frame of 12-inch boards was first built around the bed. This was made sufficiently strong by lapping the boards at the ends and by the use of a few nails and short stakes driven in the ground. The canvas was then secured to the frame by short strips of wood, and the entire structure made fly proof by hilling soil up to the base of the boards.

The plants under the screening made a good growth, and were not injured by either flea-beetle or maggots. At the time the screening was removed, June 20th, the plants were much larger than the check plants. The plants in this bed attained the size required for transplanting a week earlier than the check plants and were all set by July 3d, while the check bed which had been very much injured by maggots did not produce seedlings of sufficient size to plant.

The length of the seed-bed was 150 feet and the width was 12 feet. The items of expense for materials for the frame and covering are as follows:

200 yards cheesecloth at 2¾ cts. and cost of sewing	$6.00
324 feet lumber (12-inch) at 4 cts.	12.96
Laths, wire and tacks	1.25
	$20 21

The number of seedlings transplanted from this bed was 50,000, which makes the first cost of the frame and screening approximately 40 cents per 1,000 plants. Estimating that the screening could be used for three seasons, as is generally agreed, and that the boards could be used for this purpose for at least ten years, the cost of the materials for screening a bed, on the basis of these experiments, would be approximately 8 cents per thousand plants each year. The initial cost of the lumber could have been much reduced by having the frame more nearly square, rather than oblong.

OPINIONS OF FARMERS ON SCREENING CABBAGE SEED-BEDS.

The screening of cabbage seed-beds for protection against maggots has not generally proven successful. However, a number of growers during the past season covered a portion of their beds in the manner described in the station's experiment and all have been well satisfied with the quantity and the growth of the seedlings in the screened frames.

The opinions of a number of farmers, who have reported their results, are summed up as follows: The cost of boards is not entirely considered as an item of expense; for, if it were necessary to purchase a new supply, the value of the lumber for other farm purposes is not materially lessened. All report that in the growing of plants under screening considerably less seed is needed than by the old methods to produce the required number of seedlings, and some assert that this saving is sufficient to pay for the cheesecloth. The belief is generally expressed that the screening of seed-beds in communities where the cabbage maggot is an annual pest, is practical and the seedlings can be efficiently protected from injuries by these insects.

SUMMARY AND CONCLUSIONS.

The experiments that have been made show that by the use of tight frames, covered with cheesecloth, cabbage sets can be grown free from injuries by root maggots. The plants raised under cloth grow faster, and in average years will probably reach the desired size for transplanting earlier than the seedlings in the open beds. The screened sets are also quite liable to be more tender, and if not well hardened, are generally more subject to wilting on replanting. Present experience indicates that the seedlings may be made more resistant to the usual injuries upon transplanting by the removal of the screening for at least one week before the time of planting, and that this seasoning may be done without much risk of injuries by maggots.

Screening of cabbage seed-beds is practiced by comparatively few growers, and usually only a small percentage of the number of plants required for their purposes is at present raised under cloth. The methods that are employed in growing seedlings under screened frames often vary in minor particulars with individual farmers, and there is a diversity of opinion on such details as the grade of cloth and size of mesh to use, and the amount of seed to sow in beds to be screened, to produce the maximum number of plants, etc. More exact methods in growing sets in this manner can only be determined after more time for proof and verification. There is no question but that with screened frames, cabbage seedlings can be raised absolutely free from loss by maggots, but the practicability of the attempt, by the average grower in this state, to raise all or a large proportion of his plants under cloth, remains to be demonstrated. For this reason, we would not advise, at least for the present, the extensive use of screening; but it is hoped that cabbage growers who are subject to annual losses in their seed-beds by maggots will make at least a small test to determine the value of screened frames under their own conditions. Precise instructions can not be given in some of the details in raising seedlings by this method, as would be desirable, but observations of the practices of a number of co-operating farmers form the basis of the following suggestions to the grower who desires to test the practicability of screening seed-beds as a means of protection against root maggots.

SUGGESTIONS ON SCREENING CABBAGE SEED-BEDS.

Locate the seed-bed on a fertile and well drained piece of land, where there can be no accumulation of water or washing by rains under the frame. The ground should be free from weeds and should not have grown, the year before, cabbages or other cruciferous plants. For seed-beds it is customary to apply to the land a liberal quantity of a high grade chemical fertilizer. The seed should be drilled in rather thickly in rows six inches apart. The planting of the seed may be done at the usual season, but to avoid injuries by the flea-beetles it would be well to delay the seeding till the appearance of the beetles, which will largely have satisfied their ravenous appetites by the time the young plants appear. As the seedlings begin to show above ground, screen the bed immediately. For the frame, 12-inch boards are generally employed, which are held in place by upright stakes. To prevent the covering from sagging in the middle a heavy wire, running the length of the bed and a little above the height of the boards, and supported by stakes, is used. The screening, consisting of three or more widths of cheesecloth, sewn together to make one sheet, should be fastened to the frame by laths, through which small nails are driven. All openings into the bed, due to the unevenness of the ground, should be filled by banking the boards with earth. To season the plants before transplanting, the screening should be removed one week or ten days before the time of setting.

In this interval of time examinations should be made occasionally about the stems of the young plants near the surface of the ground for eggs, deposited by flies coming to the bed from the outside. When any are discovered, transplanting in the field should commence.

DISCUSSION.

MR. STEVENS.— What is the variety of cabbage planted?

MR. SCHOENE.— Several varieties, one the Danish, and another the ordinary domestic cabbage.

MR. STEVENS.— Did you notice, when setting these plants out, any difference in the effect of the sun on those grown under the screen and those out in the open?

MR. SCHOENE.— One of the reasons why the growing of cabbage plants under the screen by farmers has been unsatisfactory is that they neglected to harden the plants by taking off the screen before replanting the plants.

The Year's Work in Spreading Alfalfa in New York State.

By J. L. Stone, State College of Agriculture.

I shall occupy your time a very little while. I did not know until I saw the program that I was expected to say anything on the subject. I know many of you have visited us heretofore and seen the work that has been done on our Mitchell farm. We have some land there that, as is well understand, is not adapted to alfalfa, and the question was to manipulate that soil to get alfalfa to succeed on it. We have been experimenting three or four years, having had several series of experiments running, and much of the area has been such a complete failure that several of the experiments have been plowed up to make room for new stock.

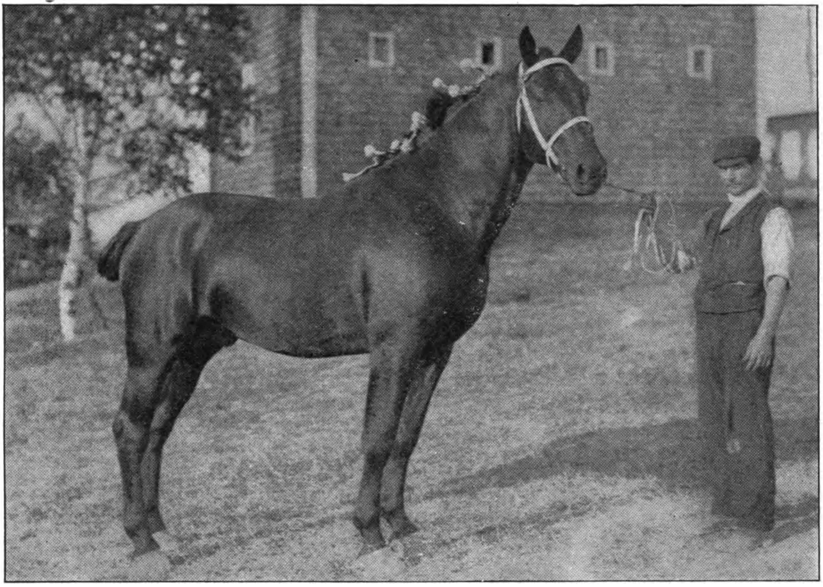
I might name some of the things we have learned. That soil is qualified by the department as a Dunkirk silt loam. The farmer would call it a tenacious clay. The teaching has been this, that on that soil there are three things absolutely essential, viz.: We must manure it the season we sow the alfalfa, give it a good coating of manure; we must lime it and we must inoculate it. If we leave out any one of them the experiment falls down surely.

In 1905 we had an acre of land that was laid off into something like twenty plots, upon which we tried a large number of different methods and ways in duplicates. We were mostly successful, but there were some failures, and inasmuch as we thought we had our lessons learned, we plowed that acre again and succeeded in growing a good acre of alfalfa in 1906.

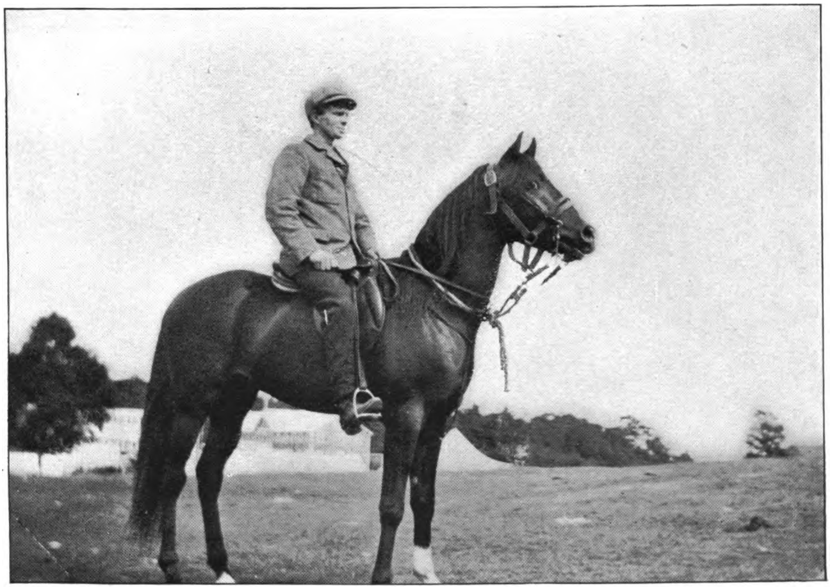
The land was plowed in the spring of 1906, and it was not sown until about the 10th of August. In the fall it had a good, very promising, uniform stand, over the whole area. We watched it with a good deal of interest. In the spring, after the break-up, and after the freeze and thaw of spring, we looked it over and came to the conclusion that it was a failure. So many of those plants had been drawn out on top of the soil, we thought there was no possibility for recovery. You remember the spring was very late. However, when favorable growing weather did come on, enough of those plants held on to make a very good showing. We had a thick stand. The final results, so far as this one year's experience is concerned, are very satisfactory. At the first cutting we got three tons of alfalfa hay per acre. This hay was not weighed on account of its location. We had no scales there. We did not weigh those loads, but the man who did the work assured us the loads were just as large as those which came from other fields that we did weigh. At the second cutting we got two more, making five tons of fine alfalfa hay from one year old seeding. A great many of those plants that did grow and help to make this crop were pulled four to six inches from the soil. Whether they will stand another year, I do not know. We are much interested to watch that acre and see whether it can go through an ordeal of this character and win out another year. I am certain that on that sort of land, by giving it proper treatment, we can get temporary success. Until it is tile drained there will be no permanent success, but I believe when it is tile drained, we will get alfalfa seedings that will stand for some time. I believe for eight or ten years.

Just a word in regard to the discussion. It seems to me our University farm indicates the conditions in a large part of the State. On the College farm, in some parts, it is no trick at all to grow alfalfa. Dr. Lyon and Dr. Warren, Western men, tell us that on such land you can beat the Western farmers growing alfalfa. On the other hand, we go on another part of the farm where the soil is different and we have an altogether different sort of conditions.

I have been struggling on my own farm in Pennsylvania. My farmer is anxious to grow alfalfa on a field which grows 250 bushels of potatoes to the acre. We have been trying to grow alfalfa on that field. We have tried inoculation, lime, etc., year



German Coach Stallion.



Arabian Horse.

after year, but we haven't grown alfalfa successfully. I know that field has had the very best that can be done for it and it is considered good land.

DISCUSSION.

Question.— How did you spread the manure?

Mr. STONE.— Usually we have spread the manure on in the furrow and worked it in with the harrow. We haven't observed any difference in this particular line of experiments. My theory, based upon farm experience, is, that it doesn't make much difference as long as it is there.

One of the things that the novice falls down on in starting in on alfalfa is that the weeds come up and kill the alfalfa.

Question.— Have you anything to recommend about the time of sowing and the previous cultivation in keeping down or destroying the weeds?

Mr. STONE.— If the ground is known to be foul, I would recommend late summer sowing. In one of our experiments we got into trouble. We had a lot of clover in it, and the clover overran the alfalfa. By giving the land a thorough fitting and sowing late, while the weeds start, the first freeze kills them. The best recommendation on wet soil I can give you is, fit the land early, as soon as it can be worked well in the spring, and then kill a number of crops of weeds. As to sowing, I am favorable to August. Sow when you can get the right weather.

Mr. WARD.— How long before the seed is sown would you advise to sow the lime?

Mr. STONE.— I should have the lime put in some time before, as soon after you can work the soil in the spring as is convenient. The action of the lime is not felt very quickly. If you could have the lime in the soil some weeks or months before the seed is sown, the alfalfa would get the benefit of it, I think.

Question.— Have you found any counties where you have experimented that alfalfa cannot be grown successfully?

Mr. WILSON.— If I remember correctly, I don't think there is any county in the State but can grow alfalfa.

Question.— I was in Sullivan county two weeks ago, and they said they had tried it there, and the soil was shallow and they could not raise it successfully.

Mr. Wilson.— We haven't had any experience from there.

Question.— You say every farm has some soil characteristics; that the soil must be well drained, must not be underlaid with hardpan, must have a reasonable amount of fertility and must not be strongly acid; and if it has a gravelly subsoil, it is a help to it also. Tell us the limit of hardpan. How near the surface may the hardpan come and yet succeed with alfalfa?

Mr. Wilson.— I haven't any data to give a definite answer. I should say, with hardpan, within eighteen inches of the surface you run the risk of getting a good crop.

Question.— That would be mitigated if you put in tile?

Mr. Wilson.— I think so. The hardpan does not admit of the penetration of the alfalfa roots.

Question.— What crops would you sow before alfalfa?

Mr. Wilson.— I don't know that I have had any experience as to what crops should be sown before, but I should say in the preparation of the field for alfalfa, that it should be well cultivated, plowed early and cultivated at intervals, say of ten days to two weeks. After this has been done several times, give the last cultivation, a very shallow one, and that should produce, as a rule, a very good seed-bed. That would also necessitate the sowing of alfalfa later in the season, and those conditions are much advised and approved by us in our work.

Question.— How about cultivating all summer and eradicating the weeds and sowing late in the fall?

Mr. Wilson.— We have quite a good many who are doing that. I don't know that it is better to sow early than late, but the general tendency is that later sowing is better than earlier.

Mr. Ward.— What do you mean by early and late; what is the limit of time?

Mr. Wilson.— I would say late would be any time after the 10th of August.

Mr. Ward.— You wouldn't think a man justified in sowing in September?

Mr. Wilson.— I know some men are sowing in September. I do not know the result.

Mr. Ward.— I take it your experiments have been conducted in most parts of the State uniformly. There is a feeling that there are some sections where it will not grow?

Mr. WILSON.— If there are any I haven't been able to notice them.

Mr. WARD.— I have heard people say in northern New York they could not grow it, and other people say Delaware is naturally unadapted, and up through Steuben, in that section.

Mr. WILSON.— We have some experiments in Steuben county, started last spring, and we have some experiments in northern New York, up in St. Lawrence county, running to Malone. Some of those experiments are doing very well.

Mr. WARD.— There is a general feeling there are some places where there is no use in bothering with it?

Mr. WILSON.— I don't think there is.

Mr. WARD.— There is another section up about Mayville, they say they cannot grow alfalfa; what experiments have you had in there, Jamestown and that section?

Mr. WILSON.— We have at Jamestown a Mr. Day, who has experimented out towards Randolph, and by the report I got from his field, he needed inoculation and lime. Where he had applied both he had a successful field.

Question.— Old farmers will classify soils by the first timber; I think hemlock soil is not adapted to alfalfa, but where you find open chestnut, my opinion is you will succeed with alfalfa.

Mr. WILSON.— I could not say, I am sure.

Question.— Have you had any experience with a light, sandy soil, like that of Long Island?

Mr. WILSON.— We have some experiments on very sandy soil around Rochester. The results are in favor of lime.

Question.— Then you get a paying crop, do you?

Mr. WILSON.— Yes. We started an experiment in Saratoga county in 1905. It was a failure. We tried alfalfa in two different places this year, and so far he has had marked success on one and on the other not very good. The first field he sowed was cutting the second time the last of August.

Question.—How much seed do you sow to the acre?

Mr. WILSON.— We advise twenty to thirty pounds.

Question.— How do you advise sowing it?

Mr. Wilson.—A great many farmers sow it broadcast; some have used a hay seeder and then sowed it two ways so as to get it evenly distributed over the field.

Mr. Dawley.— I do not know that there is very much left to be said in the growing of alfalfa. I want the institute workers to encourage every man to attempt growing it, no matter if he seems to think he cannot grow it on his land. Encourage him all you can and give him all the information you can. The chief difficulty to-day with those who are not successful is they do not want to grow it badly enough. There are, of course, farms where men cannot make it grow, where the conditions of drainage and other soil conditions are such that they cannot make it grow at present. I believe, as Mr. Wilson says, if a man will make a few conditions right, which he can make right, it will help him to grow it. I known dozens and dozens of men who were just as positive they could not grow it, who last year had pretty good crops. I would not advise any man to plant very large areas where alfalfa is not growing.

Mr. Ward.— Every winter we are asked the question, " Where can I buy good alfalfa seed?" Are we justified in recommending any particular seed growers?

Mr. Dawley.— In a general way, I do not believe any institute worker is warranted in recommending any particular seed. I should advise buying from the better class of seedsmen located near the purchaser, and with a reputation to sustain, who will give something better than the ordinary guarantee that the seed is free from dodder.

Mr. Flanders.— I have the impression in the first place you want to drain your soil, in the second place I heard them speak of the benefit of the moisture in the soil, and I heard another last night tell about the depth of the roots, and I am puzzled on the proposition, just the conditions you want your soil in.

Mr. Dawley.— In a general way, you have got to have your soil for alfalfa drained down to four or five feet. No great amount of free water should be allowed to stay in the soil for a great length of time. You must take the care of the free water, but you have got to have the moisture scattered in your soil. To answer that question satisfactorily would take half an hour.

Mr. FLANDERS.— I am living in Columbia county. I have understood from the people there that they did not think they could raise it, on the theory that the soil at the top is dry and that the root will not go down far enough to find moisture and live in that soil.

Mr. DAWLEY.— I have an idea if you could strike a season just right in Columbia county you could get your field firmly established, and you would find you would get a good crop of alfalfa.

Question.— I think in most of these sections they require lime.

Mr. DAWLEY.— I am positive of that.

Dr. LYON.— In western Nebraska and Kansas, where the lands have water standing at a depth of from ten to fifteen feet, alfalfa is grown very successfully, if they can get it started. The soil is porous and takes moisture very rapidly, and lets it pass down in the bottom soil and that is charged with moisture. The difficulty under these circumstances is always to get the stand of alfalfa sufficiently far along for the plants to get roots down where the water supply is permanent. If there happens to be a year in which the rainfall is somewhat above the average, and the seed is sown in that year, you are practically sure of success, where, on the other hand, if you happen to sow in a year when the rainfall is low, it generally results in failure.

Tillage vs. Sod-Mulch.

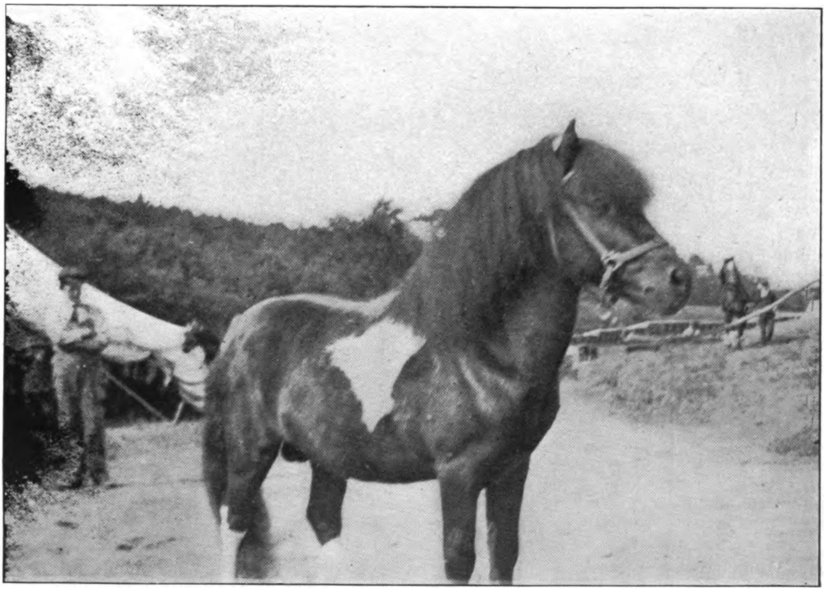
By U. P. Hedrich, State Experiment Station.

My subject implies a controversy. The disputed question is, will an apple orchard thrive and fruit better under tillage or in sod with the grass used as a mulch? The Geneva Experiment Station is conducting two experiments to settle this question. This paper is largely a report on one of these trials of the two methods of orchard management, the other not having been carried far enough to warrant a report. In a controversy of any kind terms must be defined, and to properly understand an experiment, the conditions under which it is undertaken must be considered and I hasten to these tasks.

Is it necessary to define tillage? The definition is short and clear. To till is to plow, cultivate or to hoe the soil. Tillage is an humble word with its flavor of soil and its suggestiveness of sweating toil, but is an old word and should be an honored one. It has rendered mankind untold and untellable service; it is practiced wherever there is agriculture in the world and nearly all of the plants which minister to the needs of human kind have been improved by tillage. To plow, cultivate, or hoe, to turn and stir the soil, and so improve the crop, or so improve the soil, these simple operations were the beginnings of agriculture and the beginnings of civilization and they have been the chief tasks of all civilized peoples. Tillage is so universal, and is so essential a part of agriculture that those who oppose it for any domesticated plant should look well to its origin, to its history and to its present place in agriculture before banging it and battering it and charging it with evil.

There are two words to define in the compound term, sod-mulch. Sod is soil made compact and held together by the matted roots of living grass. A mulch is an organic material placed about trees to prevent evaporation and to furnish humus. The sod-mulch

Hampshire Downs.



Pony Stallion.

advocates divide into several sects in their manner of making use of sod and mulch. One sect keeps sheep on the sod, another pigs, and still another cattle. Another says cut the grass for a mulch, while still another says the grass is not sufficient and must be supplemented with straw, or manure. Most recent of all is a new sect, those who would use stone for a mulch, who want an everlasting mulch; the founder of this sect is now preaching "stone-walls about apple-trees." Some of the sectarians in these several denominations of sod-mulchers, say that the apple-trees, to receive full benefit from their method of culture, must be planted in sod and ever after left there and that if a man is once indiscreet enough to till his orchard he is ever after cut off from the blessed privilege of sod-mulching it. Still further, in planting the above orchard, some extremists say, do not cut the sod by digging a hole for the tree, but cut the tree, lop off roots and branches and stick the stub in a hole in the sod made by a crowbar. This, however, is sod-mulch culture plus that silly dementia of modern horticulture known as the Stringfellow method.

Sod-mulch culture is applicable only to the apple. The peach, the plum, the cherry; the orange, the olive, the lemon; the grape, the gooseberry, the currant; corn, potato, and the pumpkin; the sunflower, the geranium and the forget-me-not; all these and all of their kind need tillage. The apple alone wants a soil compacted and held together with the matted roots of living grass.

Sod-mulch culture is a new method of orchard-management. We have grown apples for a long, long time — centuries — and a good many of the orchards were in sod, but the virtues of the sod and the mulch therefrom were not discovered until the beginning of the twentieth century. So, too, this method is not a universal one — unknown and unpracticed outside of a few of the eastern states. Oregon, California and Colorado, though they produce apples that surpass the world in many respects, and though they have all kinds of soil, and though their various soils are both irrigated and farmed as dry lands, yet the sod-mulch culture has not found a place in any of their commercial orcharding districts.

We can understand the experiment to be discussed better if we take a brief glance at the philosophy of tillage and that of sod-mulch. The objects of tillage are so well set forth by one of the leading living authorities on the subject, Professor F. H. King, that I give them without a change of a single word.

"(1) To secure a thorough surface uniformity of the field, so that an equally vigorous growth may take place over the entire area.

"(2) To develop and maintain a large effective depth of soil, so that there shall be ample living-room, an extensive feeding surface and large storage capacity for moisture and available plant-food materials.

"(3) To increase the humus of the soil through a deep, and extensive incorporation of organic matter, so that there may be a strong growth of soil micro-organisms and the maintenance of a high content of water-soluble plant food-materials.

"(4) To improve the tilth and maintain the best structural condition in the soil, so that the roots of the crop and the soil organisms may spread rapidly and widely to place themselves in the closest contact with the largest amount of food materials.

"(5) To control the amount, to regulate the movement, and to determine the availability of soil-moisture, so that there shall never be an excess or deficiency of this indispensable carrier of food materials to and through the plant.

"(6) To determine the amount, movement and availability of the water-soluble plant-food materials present in the soil, so that growth may be both rapid, normal and continuous to the end of the season.

"(7) To convert the entire root zone of the soil into a commodious, sanitary living and feeding place, perfectly adapted to the needs of the roots of the crop and to the soil organisms, adequately drained, perfectly ventilated and sufficiently warm.

"(8) To reduce the waste of plant-food materials, through the destruction of weeds, and the prevention of their growth, through prevention of surface washing and drifting by winds."

It is impossible by any other means than tillage to obtain for the apple the conditions enumerated above: soil uniformity; soil depth or a commodious living room; an increase of humus; improved physical condition of the soil; conservation and regulation of moisture; greater availability of plant food; a sanitary living place, clean drained, ventilated and sufficiently warm; and the destruction of weeds. Are not these objects worth striving for with any cultivated plant?

I am fortunate, too, in being able to give the philosophy of the sod-mulch and in the words of Mr. Grant Hitchings, who, as all know, has been one of the chief advocates of it. Mr. Hitchings says:

"This system gives one practically the whole spring and summer to grow and market other crops, while the orchard is growing of its own accord a supply of vegetable matter for humus that all authorities agree is so necessary for proper soil maintenance. This means that you can do a good business without extra help, growing strawberries, green peas, early potatoes, etc., and have the money for the fruit in the fall to swell your bank account, instead of paying it out for fertilizers and cultivation. Other advantages are that you can drive through your orchard to spray better on sod than on cultivated soil, as the latter sometimes gets muddy, and also washes badly on rolling ground. You can allow your apples to mature fully on the trees, for if they should fall on the grassy mulch nine-tenths of them would be marketable. By making repeated gatherings the yield will be largely increased and quality improved. With the mulch method you accumulate humus in your soil; with clean cultivation, you burn it out or exhaust it."

Reduced to its simplest terms this statement claims that the sod-mulch method is a cheap and easy way of getting apples. In fact, the chief claim made by most of the sod-mulch advocates is for the cheapness of the method. If the reasoning of the sod-mulchers be put in the form of a syllogism the major premise is: "Cheap methods give most profits in apple growing." The minor premise: "The sod-mulch method is a cheap one." Conclusion: Therefore, the sod-mulch method is the most profitable one. Never was there a greater fallacy than that expressed in the major premise that "Cheap methods give most profits," and it is one upon which thousands of agriculturists found their practice in growing other crops, usually to their loss and often to their ruin. It is not cheap methods that give most profits; it is low cost of production that gives profits. Now, the sod-mulchers can and do show that their method is a cheap one. But do they show that it lowers the cost of production of a bushel of apples? There is only a change in one letter between *cheap* and *cheat*. In one of the above sentences my stenographer made a mistake and wrote of sod-mulch, "a cheat way of growing apples." On the showing of the above syllogism I am willing to let the mistake stand. The man who practices cheap methods too often cheats himself.

We are now ready for direct evidence as to the relative values of tillage and sod-mulch for the apple. How do the systems of management pan out in a commercial orchard? The orchard in which the Geneva station has for four seasons tried the two methods is located on the farm of Mr. W. D. Auchter at South Greece, New York. The orchard consists of ten acres of Baldwin trees thirty years old, five acres tilled, five acres in sod. The soil is a medium heavy clay loam, rich, and containing enough gravel to make it porous. It was selected as typical of the average orchard soil of western New York. The experiment being carried on is a broader one than a simple trial of tillage and sod-mulch. The experimenters hope to add something to what is now known about the food and drink of trees — how trees take them in, make use of them, and with what effects; what influence soil temperature and soil ventilation have on the development and function of tree roots; and among still other problems, what the relationships between grass and the apple may be.

It should be said, too, that the experiment is to run ten years at least and that the results now given do not cover half the minimum period and are, therefore, in some respects, inconclusive and superficial. For instance, the discussion now centers around the yield of fruit. While, of course, the crop is the ultimate criterion of orchard treatment, yet the effect upon the tree as indicated by the leaf, wood and root development is quite as important an index of the value of tree treatment as the crop of fruit.

The care of the two plats in the Auchter orchard has been as follows: The tilled plat is plowed in the spring and cultivated from four to six times ending the cultivation about August 1st, at which time a cover crop of barley, oats or clover is sown. On the sod-mulch plats, the grass is cut once or twice during the season and allowed to lie where cut and decay into a mulch. The grass crop has usually been large, last year it was enormous, thick and tall, standing to the top of the fore wheels of a buggy, and no one could say that it was ever insufficient for a good mulch. In all other details of care the treatment has been the same in the two plats.

Mr. Hitchings publicly contends that the orchard should have been for some time in sod to have made the test a fair one. In reply it can be said that the orchard was in sod, though the trees were not mulched, for most of the first twenty-five years of its life previous to its being taken for this experiment. The roots of the trees ought to have gotten used to sod during that time. This experiment has been going four years now, and the trees, as we shall show, are not yet "broke in" to taking their food and drink in the same trough with grass. As the "breaking in" is telling badly on these trees, we may well ask, how long will it take to make a sod-mulch orchard out of a tilled one?

It should be of interest to know what happened in the Auchter orchard during the quarter century it was not tilled. Sometimes figures talk. At the end of the twenty-five years in sod the Auchter orchard was sold to the present owner as common farm land. Its former owner had contemplated cutting it down as worthless. *After several years of tillage, the orchard is paying Mr. Auchter, for an average of a number of years,* 10 *per cent. on a valuation of* $1,000 *per acre.*

A member of the staff of the Ohio station, who says that his institution is the "original official champion" of sod-mulch culture for the apple, claims that proper methods of mulching have not been used in the Auchter orchard, that the cut grass is not sufficient and that straw litter of some kind ought to have been added to the grass mulch; this is the "original official" mulch, as near as I can make out, of which the Ohio station is "champion." In answer to this criticism, I have only to say that there are not many who follow the Ohio method in New York. Sod-mulchers in this State mostly follow Mr. Hitchings' way of simply cutting the grass for a mulch and therefore this station is testing his method.

Another fruit grower says in a printed statement that "it would have been a fairer test if the grass had been cut earlier — twice during the season and raked and piled under the spread of the trees, instead of all over the ground." In reply we can say that in two of the four years the experiment has been running the grass was cut twice and without at all lessening the deleterious effect of the sod-mulch treatment on the trees. I am sure that this man is wrong in advising that the grass be "raked and piled under the trees." The roots of the trees in the Auchter orchard intermingle at all points, as they do in most old orchards, and a mulch should, therefore, cover the whole ground.

The ultimate criterion of the relative merits of the management to which an orchard is subjected is the crops of fruit obtained. It is important, however, that trees should grow well and for the measure of vigor there are several characters of the trees available, as the leaf area on the tree, the length of new wood formed, the number of new shoots and the color of leaf and wood. The properties of the fruit, as size, color, time of maturity, keeping qualities and flavor must be noted. We come now to a discussion of these criteria.

The effects of the two methods of management on yield of fruit are shown by the following figures:

	Bbls. Sod.	Bbls. Tillage.
1904	615.1	591.9
1905	233	278.9
1906	210.3	531.1
1907	275	424.3

Average yield per acre on the plats for the four years; sod, 66.6 barrels; tillage, 91.3 barrels; difference in favor of tillage per acre, 24.7 barrels. These results scarcely need comment. For an average of four years the tilled plat shows an increase of a little over one-fourth above the sod-mulch plat. The figures first read show that each succeeding year the difference becomes greater, indicating a continuous loss of vigor in the sod-mulch trees.

One of the chief advantages of the sod-mulch method, as put forth by its promulgators, is that it is a much less expensive method of caring for an orchard. The average expense per acre of the two methods of management for four years was $15.72 for the sod, $22.12 for tillage, a difference of $6.40 in favor of the sod. It is true that the outgo has been greater for the tilled plat, but the income has been greater. The cost of production has been materially less for the tilled trees and that is the main point in the whole discussion. A cheap and easy way of growing apples is not necessarily the most remunerative way.

Leaving the yield of fruit for a brief consideration of the effects of the two treatments on tree characters, we can mention first the leaf area. Measurements of leaf area were not made, but the merest glance through the orchard would show that there were more and larger leaves on the tilled plat than on the sod-mulch plat. The experienced orchardist knows that sparsity of foliage and smallness of leaf can indicate but one thing, ill-health.

So, too, there was something amiss with the color of the leaves. It did not need a trained eye to detect the difference in color of foliage in the two plats. The dark and rich green of the tilled trees could be noted a half mile from the orchard, indicating an abundance of food and moisture and the heyday of health, while from the same distance it could be seen that the foliage of the sod-mulch trees was pale and sickly. Of all the signs of superiority of the tilled trees, the color of the foliage spoke most eloquently and more than one man of the hundreds who visited the orchard was heard to say, as his eyes lighted on the contrasting colors of the sick and of the well trees, "that satisfies me." The absence in color in the leaves of the sod-mulch trees was due to a lack of chlorophill or leaf-green. Chlorophill is essential to the assimilation of plant-food and when it is lacking the trees become starved and stunted. The leaves on the sod-mulch trees assumed their autumnal tints a week or ten days earlier than those on the tilled trees and the foliage dropped that much earlier, thus seriously cutting short the growing season of the grassed trees and thereby impairing their future vitality.

The new wood produced by the grassed trees tells a similar tale of injury. It was not half that produced on the tilled trees; the twigs were not plump and well filled out; there were fewer new shoots; and the wood of the mulched trees lacked the clear, bright, rich brownish tint of health so that in mid-winter one could pick out mulched trees and tilled trees by the color of the wood.

The most remarkable differences to be noted in the qualities of the fruit were in size and color. The size of the fruit averaged considerably larger on the tilled plats. The greater yield in the tilled plat of the orchard must be attributed to the increased size of the fruit, rather than to an increase in number of fruits. This statement is based upon the facts that the trees in the two plats bore equal quantities of blossoms and about equal numbers of fruit, but the size of the tilled fruit was much greater.

As to color, there is no question but that the fruit from the sod-mulch plat is much more highly colored than that from the tilled plat. This difference varies with the season. Mulched fruit ripens from a week to two weeks earlier than tilled fruit. If the variety and the season are such that the tilled fruit can remain on the trees some days after the mulched fruit must be picked, the difference in color is much less. The lighter color of the tilled fruit is readily and clearly explained. The coloring matter in the skin of the apple, like that in the leaves, consists of chlorophill or leaf-green. The coloring of ripening fruit is due to the changing of the chlorophill of the skin into a red-colored substance, just as in the leaf it changes into the colored substance of autumnal tints. Therefore, since the sod fruit ripens earlier it colors earlier and, in most seasons, better.

The abnormally high color of the sod fruit in this orchard is one of the most marked signs of the deleterious effect of the sod on the trees. Every man of experience has observed that when a tree is starved, stunted, girdled or injured, its foliage and its fruit take on high color. Radiant color in fruit or leaf is often the hectic flush of a diseased patient. The bright color of the fruit in the sod-mulched trees may be purchased at the expense of the vigor and the health of the tree.

The later ripening period of the fruit on the tilled plat would be a defect with some varieties and in some localities, but, in general, in New York late ripening is an advantage.

Fruit from both plats for the four years have been kept in cold storage to test the relative keeping qualities. This work has been in charge of Mr. G. H. Powell, the cold-storage expert of the United States Department of Agriculture, who writes me in brief: "There appears to have been little practical difference in keeping quality between fruit from sod land and fruit picked a few days later from the tilled land."

There is no difference in quality. If one shuts his eyes to the color and eats a Baldwin from a mulched and from a tilled tree from the two plats, he can detect no difference if the fruit be of the same degree of ripeness.

In considering the causes of the differences noted between the two systems of management, we can do little more than state the hypotheses which seem to account for the results. The experiment is by no means concluded and definite reasons cannot be advanced until all the proof is in. Yet, it seems to me, I am warranted in offering the following hypotheses:

1. Plant-food is more available in the tilled plat than in the sod plat. That there is an abundance of the plant-food necessary for the welfare of the trees and the production of crops in both plats is certain. For the trees in the tilled plats showed, in all respects, good feeding, and such trees in the sod-mulch plats as could get any considerable portion of their roots in soil where there were no grass roots, likewise seemed to be well fed. Moreover, two of the chief elements of plant-food, potash and phosphoric acid, were added to a part of the trees in each plat for three successive seasons and without appreciable results in either case. It is evident that there is plenty of food in the acid land, but for some reason it is not available to the apple trees. The trees are starving in a land of plenty.

2. The sod-mulch does not conserve moisture. The chief study in the Auchter orchard for the summer of 1907 was that of the water content of the soil in the two plats. One hundred samples of soil were taken at different times during the summer and under conditions safeguarded in every way possible to determine accurately the amount of moisture in the soil. The analyses showed, approximately, that the water content in the tilled soil during the past summer was twice as great as in the sod plat, thereby

substantiating what has long been claimed, that tillage is a better means of conserving moisture than mulching.

The difference in the moisture conditions of the two soils is enough to account for the difference in crops and trees in the two plats. Trees must have water. If an apple tree bears ten barrels of fruit, there are about eight and one-half barrels of water in the tree's output. In a full-grown apple tree it is estimated that the total leaf area is about 1,000,000 square inches. Mr. F. C. Stewart of our station has counted the stomata or pores on a square inch of the apple leaf and finds that a fair average is about 150,000 per square inch, or for the leaf area of the whole tree, 150,000,000,000 pores. Now to supply the demands of its ten barrels of apple children while these 150,000,000,000 pores are constantly giving moisture, is enough to drive the tree to drink and the apple tree becomes a hard drinker. When in the heat and drought of summer, the apple tree is compelled to share its scant supply of water with the thirsty hordes of hangers-on found in an orchard sod, the trees must suffer. Still further, a diminished water supply entails a cutting off of the food supply. Plant-food enters the tree as a solution, and an apple tree suffering from lack of water as a necessary consequence suffers from a lack of food. A thirsty plant is a hungry plant.

3. The sod-mulch soil is less well aërated. In the experiments we are carrying on, I have not attempted to secure evidence on this point. It is obvious that sod interferes with the air supply in the ground beneath it and it is not hard to believe that such interference would hinder the proper development and prevent the proper work of roots. The muffler of mulch which forms a part of this system of orchard management would, of course, intensify the deleterious effects of the sod in the above respect.

4. The soil temperature is lower in the sod-mulch plats than in the tilled plats. It is possible that the harmful action of grass on trees may be accounted for, in part, by the influence of the sod on the temperature of the soil. During the summer of 1907, the soil temperatures were taken in the tilled and mulched plats twice a day for forty-one days, at the depths of six and twelve inches and under as nearly as comparable conditions as circum-

stances would permit. At both depths the difference was in favor of the tilled plats. At six inches the difference was slight, being only one-third of a degree but for the greater depth, twelve inches, the average in favor of the tilled plat was one and three-fourths degrees. It is not an assumption to say that the higher temperature is more favorable to the growth of the apple tree, for plant physiologists, soil physicists and bacteriologists agree that an increase in soil temperature is favorable to plant growth. As one of them puts it: "The soil is a great factory that has its production vastly increased as the temperature rises."

5. There are probably differences in the biological or "germ life" activities taking place in the soil. This is a matter upon which I am not qualified to speak with certainty. But I know that the men who are studying soils find that there are various kinds of micro-organisms inhabiting the soil which have much to do with the proper functioning of the roots that grow therein. The soil is teeming with countless millions of living organisms which bring about necessary changes of one kind and another in that soil; without them higher vegetation would not grow. Now, the activities of these beneficent organisms are dependent on soil conditions, and King tells us, in the quotation given above, that tillage induces a strong growth of soil micro-organisms; that "it improves the tilth so that soil organisms may spread readily and widely; and that it converts the root zone into a commodious and sanitary living place for the soil organisms."

6. The grass may have a toxic or poisonous effect on apple trees. At the Fifteenth Annual Meeting of this society, the speaker gave an account of a series of pot experiments which seemed to show that grass roots in some way poisoned growing peach trees. The United States Department of Agriculture has published a number of observations and experiments to show that different plants growing in the same soil may poison each other.

I am able to give also the results of a most excellent series of experiments planned and carried out on the Woburn Experimental Farm in England. These experiments were planned to show the effects of growing trees in grass, the latter to be used as a mulch. The following gives the gist of the results of the experiments in question:

"As to the general effect produced by grass on young apple trees, the results of the last few years have brought forward nothing which can in any way modify our previous conclusions as to the intensely deleterious nature of this effect, and we can only repeat that no ordinary form of ill treatment — including even the combination of bed planting, growth of weeds and total neglect — is so harmful to the trees as growing grass round them. * * * The evidence which we shall bring forward will, we believe, be sufficient to dispose of the views that the grass effect is due to the interference with either the food supply, the water supply or the air supply of the tree, and that it must, in all probability, be attributed to the action of some product, direct or indirect, of grass growth which exercises an actively poisonous effect on the roots of the tree." I do not put forth the statement that grass poisons the apple as one having been proved, but I say that it may be so.

In conclusion, the reader is warned that particular cases do not warrant general conclusions. The Auchter experiment is in many respects a particular case and the apple grower must bear in mind that under other conditions, his own perhaps, the trees might have behaved very differently. The Auchter orchard was selected as being typical of western New York conditions and the results obtained may, therefore, be regarded as especially applicable to this region. But there are peculiarities of soil and location which might change them even in western New York. It is a simple matter for an orchardist to plow up a part of a sodded orchard and cultivate it for a few years; or as easy for one who has a tilled orchard to lay a part of it down to grass, cutting the grass as a mulch, and in a few years he can see what happens. We want more experimenters among fruit-growers and these are good experiments to try when a man becomes dissatisfied with the crops of apples he is getting.

The opportunity of giving another warning cannot be lost. The sod-mulch method is heralded as the cheap-and-easy method. But some men cannot stand cheap-and-easy methods. If they begin by applying it to tillage they are likely to look for a cheap-and-easy way of planting, the Stringfellow way for instance, a cheap-and-easy way for pruning and a cheap-and-easy way of spraying.

Some will disembarass themselves with the necessity of taking care of their trees at all and in the end will wind up as "ornery," no-account apple growers. I do not mean to say that all will, but some of them will. You remember, no doubt, in "Pilgrim's Progress" how Bunyan's characters had their natural associates. Thus, the young lady whose name was Dull chose as her companions, Simple, Sloth, Linger-after-lust, Slow-pace, No-heart and Sleepy-head. Cheap-and-easy has his natural associates and they are a bad lot. Take care how you cultivate their acquaintance. Better keep them under a sod-mulch.

There is an argument for tillage to be made from the standpoint of sentiment. The sentiment of the orchard is worth something both because there is more than the money-making side to apple-growing, and because a man with sentiment for his vocation succeeds best. "Where no pleasure is, no profit is taken," and "The labor we delight in physics pain." My argument is that when a man plants an apple orchard he should materialize his mind and his soul into trees and fruit. He can't do too much for his trees or do it too well. Bryant makes us feel this when he says:

"Come, let us plant the apple-tree,
Cleave the tough greensward with the spade;
Wide let its hollow bed be made;
There gently lay the roots, and there
Sift the dark mould with kindly care,
And press it o'er them tenderly,
As round the sleeping infant's feet
We softly fold the cradle sheet;
So plant we the apple-tree."

Bryant was not a disciple of Stringfellow. You lose all of the poetry and all of the sentiment of the orchard when you plant a tree in a hole made with a crow-bar and suffer it to remain in sod that you may, to quote Mr. Hitchings, "do a good business in growing strawberries, green peas and early potatoes." The "Divinity which orders Nature" never meant that an orchard should be so planted and so cared for.

In chemistry, physics, astronomy and all of the exact sciences, the workers constitute a jury of keen, trained men before which new doctrines can be tried. The jury is always sitting and false doctrine is quickly weeded out. Agriculture has no such jury. Its workers are scattered; many are apathetic; they differ in training and in degree of intelligence; and they speak many languages. There can, therefore, be no suitable jury to try new doctrines, and there are no recognized authorities to approve or disapprove of them. It comes about, therefore, that false and erroneous doctrines often grow unheeded and choke out the true and the useful. Agriculture needs now and ever to be defended against false doctrine. I am venturing to play the part of a defender this afternoon, and if I have gone far in defense of tillage and in condemtion of sod-mulch it is because there is need.

Closing Remarks.

By Dr. L. H. Bailey, Dean, State College of Agriculture.

It seems almost too bad to say anything to you who have been talked to so much, so all I can say is that we are glad to have you here and open the facilities of the college to you. I am sorry the time has not been sufficient for you to see all of the parts of the buildings. These buildings and the equipment are not yet all in place, but we are hoping that a good many of you will come here again at the Farmers' Week, which occurs the latter part of February.

We have an experimenters' league which has been meeting here for some years, which has for membership the old students of the college and others associated with them. Last year we extended this idea somewhat and had farmers take part in the discussions of the experimenters' league, and the demand has grown, until we are expecting to have a farmers' week closing the winter course term in February. This comes after all other societies have had their meetings, and we should like to have the farmers know about it.

If any of you wish to know anything about the college, I should be glad to tell you about it. There are eighty persons employed on the staff of the college, costing us $230,000 to run it. The current expenses come from four sources, the State of New York, the Federal Government, Cornell University and our proceeds. In the dairy department we realized something like $30,000, and that comes back to us to be used for current expenses. The pay-roll is about $98,000. This is exclusive of stenographers, janitors and ordinary help. That is the teaching and experiment staff. That tells something of the growth of the institution, and while to some it may seem large, we think the opportunities for work have scarcely been touched in many directions in the college, and that in the next five or ten years the college ought to double itself in men, equipment and efficiency. I regard the institute work as exceedingly important. I regard all three branches of the work in New York State, the work in connection with the Department of Agriculture, the State Experiment Station and our own work here as co-ordinate, and they are working together toward one common good. It is a matter of commendation to us all. It seems to me the Farmers' Institute work is a great engine enthusing the people, stirring them up and inspiring them with the idea of getting themselves acquainted with the land. All of these agencies are going to redirect New York State in ten years from now. This is the great question before the State now, to improve its internal development.

DISCUSSION.

Question.— Can you give me the date of the farmers' meeting?

Mr. BAILEY.— It is the week which includes Washington's birthday. The whole week is going to be given over. It is the wind-up of the winter course. That ought to be a very important meeting, not interfering at all with any interests in the State.

Question.— You will be glad to have the people know about it?

Mr. BAILEY.— Yes.

Mr. GOTT.— What are the terms of admission to the short course?

Mr. BAILEY.— They are none in the State, outside of the State, $25. All persons who come to the winter course are requested to bring a letter or testimonial from somebody in their locality who stands well. This is from their pastor, their teacher, or some one else who is well known in the community. There is a regular application blank and they fill out the blank. We must be careful in taking the winter-course men, they come without graduation, without preparation, and, therefore, we are likely to have no knowledge of them beforehand. We wish, in every way we can, to protect ourselves against persons who really might not want to get the full benefit of the course.

Mr. GOTT.— Don't you get a sturdy lot of men?

Mr. BAILEY.—We get a study lot of men. They haven't the university and college way, which I think in some ways is a credit. We have also a women's department of home economics, which I would like to have spread to the farm women in the State. They are of equal number and of equal importance to the agriculture of the State, because if the home conditions are not attractive, socially good and right, we are not going to keep the young men on the farms. We have not done very much for the real farm home. We have had a primary course of lectures for two winters. We are now getting our laboratory fitted up for home economics' work, and it is the only one for farm women in the State. This winter course opens next week, and after this is thoroughly organized it ought to be patronized by the State. We are hoping that the boys will bring their sisters. Sometimes married men come with their wives. The winter-course men are a strong, sturdy lot, the greater part of them come from the land. They know usually what they want; they come with a determination to work. I think we shall be obliged to provide dormitories for these men. The winter-course men come in the middle of the winter, when the rooms are taken and they have to take what they can find. I think the time is coming when the State will be under obligations to put up some kind of dormitories for the winter-course men. My feeling is to put up farmhouses for our overseers and others, in which during the winter time they can take in three or four winter men. I should like to make good, simple farmhouses, costing from $1,200 to $3,000 or $4,000, and utilize them not only for the purpose of our foremen, but to house our winter-course men, using them the remainder of the year for other students. I have never had anything to do with students which has really inspired me more than the winter-course men. I like their rough and ready ways. It costs them about $75, with the board and expenses. With the rise in the price of living, I think it is going to cost $100, on an average. That is another reason for having the dormitory system. I think some of this work is going to be taken care of in the St. Lawrence institution, but we are never going to have less men here. I might say that my attitude in regard to those other schools is briefly this: That whenever any school in the State has the equipment and the spirit in it to do real agricultural work, then we want to expend every effort to help them all we can, but we must be sure that they do real agricultural work, because so many in the past, in the name of agriculture, have not done so.

I do not think there is the danger now as in the past. Mr. Davis is a graduate of Minnesota, and took his degree at Cornell, and his experience in Wisconsin ought to be of great service in this State. Our policy is not to advise what the State government ought to do, but schools once organized, if they are really going to do real agricultural work, the more the better, we want to help them all we can.

Mr. GOTT.-- What do you say as to the graduate going back on the farm.

Mr. BAILEY.— Of course, the man who graduates may go back on the farm and may not. The colleges, Department of Agriculture, meat inspection and great numbers of such places are calling for men at the present time. We have nearly 300 students. Twenty-five or thirty is about the number we will graduate a year. Those who do not graduate do not get these positions in the public service any more, so that the men who do not graduate are likely to go back on the farm as specialists. They are our men just the same as if they had the degree. As to the graduate, having spent four years, it is a question whether at the present time the agricultural status is right for that man on the farm. It is a question whether the farming occupation has risen to that place. There are individual farms where that man can go and expend the amount of time and knowledge on that farm to advantage, but in a great majority of cases that hasn't come yet. It is coming in the future. Some persons demand that those graduates go back on the farm and are disheartened because they do not. I have no such feeling about it, at all. The time is coming when they will go back. That time has not come yet. They are going at the present time into public service, and gradually the whole agricultural enterprise will be uplifted. After a time there is going to be opportunity right back on the land for the man who has taken his Ph. D. in the university. There are many phases of this question. We are educating men to go back on the farms, winter-course men, special men. If a man, after he has spent four years, does not go back on the farm, he goes into some other work directly in line with agriculture, which helps to raise the whole status. We have got to have the fundamental knowledge.

You have got to have the absolute fact. In order to have that we must have men of the very highest training. We expect at this institution to do that kind of thing, and at the same time keep our feet on the land, serving the State directly by sending men back on the land, and helping the schools all over the State to do the same thing. I think by teaching, experimenting and writing we are going to lift the whole thing, the whole tone of the agricultural enterprise is going to be elevated.

Closing Remarks.

By F. E. Dawley, Director of Farmers' Institutes.

Now, gentlemen, the time has come when we must close this Normal Institute, and you will go out into the field to your winter's work. I predict that the winter of 1907–08 will be one of the most notable institute seasons that you have ever participated in, and trust that you may handle your work so that the greatest possible good may come to your hearers.

While individual ideas may vary as to what a Farmers' Institute is, my conception is that it is a school, not a picnic, not a social gathering, but a school for grown-up scholars, who are usually actively engaged in the practical solution of the problems under discussion, and the institute worker is sent to the student in this school to help him in his especial line of work, to enthuse him in his business, to wake and stir him up, interest him in better methods which he already knows of, and to call his attention to those he does not know of. It is to show him that there is something more in farm operation than mere drudgery, for it is a fact that only those are drudges who perform the most menial labor, who deal with dead things, and some who are doing work that is not drudgery do not realize the possibilities that confront them, and so make themselves drudges.

Farm work, both indoor and out, is not drudgery, and it is the duty of institute lecturer to explain this and impress it upon the people. This matter of enthusiasm is one of the lecturer's chief duties as an institute worker, and he must let no opportunity pass unimproved. The duties of a lecturer do not end with the lecture and the question box, but as far as his strength will allow, and his zeal lead, he must do the work of a colporteur, in season and out of season, proselyting, exhorting and teaching wherever two or three are gathered together in the cause of agriculture.

To spread zeal, one must be zealous himself. To be sure that he is zealous in the right direction, he must have facts to fortify his arguments. So each worker must be himself a student, and we hold our Normal Institutes to study. We must go to them with the same receptive frame of mind in which the best men come to our regular meetings, not in a spirit of combativeness, if we are to get the best results from our work.

In matters of policy good men often disagree, but we must decide what our policy is and stand for it. If this work is to stand, you must give the director of it and the Commissioner of Agriculture your cordial and loyal support. If complaints are made to you of our administration, come to us with them, and if the complaint is justified we will be and always have been ready to rectify it.

I have always stood up for every man on the institute force. I have in some cases, perhaps, had to apologize for shortcomings, but in doing so, have never lost an opportunity to impress the fact that I believe in the workers, and in spite of many misgivings, believe them worthy of the trust that I have imposed in them. We must have confidence in each other and in the management of the institutes, else the work will go for naught, and, so long as I have charge of the work, I shall insist on a greater development of this family or fraternal fellow feeling.

If complaints are made, report them to me at once. It is as much your duty as to "speak in meeting," even though you do not enjoy it so well. Remember that it is easy for the local correspondent to lay any apparent slight to the office force who are not there, and if you encourage this, you will find plenty of "shifters" to help you spread discord. While you should be courteous to those and report all complaints, the institute worker who does not uphold the Department until he has heard both sides has been a traitor to his trust. If any of you have not sufficient trust to do this, now is the time for you to drop out of the work.

Owing to the effects of the injury which I received four years ago while returning from the institute at Fulton, I find myself broken in health, and presume that I will not be associated with you in this work longer than the coming winter, as it is my purpose to resign at the close of this season's work. I wish to thank you for the hearty support which I have always received at your hands, and to wish you God's speed in this work which is so near my heart.

May the Great Teacher give you strength and wisdom, and put the right words into your mouth to instruct and cheer and encourage your hearers at the meetings which you will attend.

A Few Addresses Delivered

AT THE

Farmers' Institutes.

Hints for the Home Nurse.

By **Bella Millar**, College of Agriculture, Guelph, Ontario.

Every one recognizes the fact that a man or woman will succeed best in the line of work that they have a natural inclination for. There are certain qualifications necessary in order that a person may be called an ideal nurse.

We expect the "ministering angels" to be beautiful in character, amiable in disposition, to have perfect self-control, great presence of mind, to always do the right thing at the right time and say nothing about it. It is for us to take a page out of the nurse's book, because what we expect in a nurse we should apply to ourselves. Many people who would not take up nursing as a profession are sometimes called upon to render service in their homes, and a little knowledge helps them in their work.

The medicine is only one of the many things that tend toward the recovery of the patient. A bright cheery nurse; pleasant surroundings; good food, properly prepared; plenty of sunlight and fresh air — all these things are as necessary as the drugs.

The comfort of the patient is one of the first considerations, and that means comfort of mind as well as comfort of body.

There is always an extra outlay of money when there is illness in the home, and it is for the one acting as nurse to guard against unnecessary expense. For example, when ordering food supplies, always get the best quality, but it is not necessary to procure large quantities, as the invalid will soon tire of any one thing. When cooking the food prepare only a small amount and thus avoid waste.

The three vital signs are temperature, pulse and respiration, and it would be well if every one had a better understanding of these important points. It is said that the day is coming when there will be a clinical thermometer in every home, and it will repay the home nurse to acquire the knowledge necessary to use the instrument intelligently and to read it accurately.

There are many lessons for the home nurse to learn — one of the first is to learn to obey the doctor and carry out his orders explicitly. No private home is provided with hospital equipment and we must learn to think quickly and to make the best use of available material, for the home nurse will often be called upon to improvise.

No home should be without an emergency shelf or medicine chest. Having supplies on hand means much in case of accident or sudden illness.

Having a knowledge of what to do in such cases is invaluable, for if we do not know what to do we cannot act and prompt action counts for so much in an emergency.

The home nurse will find it necessary to know how to apply the roller bandage.

The following are the general rules given by Dr. Collie:

(1) The bandage must be tightly rolled up before its application.
(2) Begin by placing the outer surface of the roll next to the skin, in order that it may readily unwind.
(3) Never unroll more than two or three inches of the bandage at a time, and if by accident more is unrolled, roll it up before proceeding.
(4) Always commence by making a couple of turns round the limb to firmly fix the bandage.
(5) Bandage from below upwards.
(6) Bandage from within outwards over the front of the limb.
(7) Each turn of the bandage should as a rule overlap two-thirds of the preceding one.
(8) In reversing, the turn should be kept parallel and at an equal distance apart, and downward toward the extremity of the limb.
(9) Always form a figure of 8 at a joint.
(10) Apply the bandage firmly or it is useless. If the edges turn up on running the hand down it, the bandage is too loose.
(11) The bandage must not, however, be made excessively tight, as the circulation may be impeded or even stopped.

(12) The pressure must be equally applied throughout. If on removing the bandage red lines are found on the skin, it is an indication of unequal pressure produced by the edges.

(13) Fix the bandage securely at the end by pinning it.

(14) Never attempt to reapply a bandage without at first completely winding it up. This should be done firmly and evenly, otherwise it is impossible to apply it properly to a limb.

(15) In taking off a bandage, gather the slack into a loose bundle and pass it round and round.

Future Institute Work.

George E. Ballard, Vega, N. Y.

As evidence of the interest I take in institute work and all other gatherings where farmers meet to discuss topics of mutual interest, I am here with you to-day, not only on account of this interest, but also because of the belief that those who take a part in the talks and discussions will derive more benefit than those who are here merely as spectators. With these thoughts in mind, and upon receiving a very cordial invitation from your local secretary for a short talk, I consented to have "Future Institute Work" put on the program and with your permission will give some of my views on what should be a part of the work of our institutes in the future. The people of our State have long taken interest in educational matters along the various lines. As early as 1842 or 1843, the State Agricultural Society secured the services of lecturers upon agricultural topics, with the view to improving the general agricultural conditions throughout the State. This proved to be of so much benefit that in 1887 the Bureau of Farmers' Institutes was established, from which much benefit has been derived. At present another great movement is on foot, viz., to teach the children in the common schools nature study and the rudiments of agricultural science.

One of the greatest missions of the Farmers' Institute in the future will be to teach the farmer how his children should be taught, and also to teach him that they should have practical knowledge first of all. I can best illustrate this by my own experience. I attended a common school until nearly twenty years of age, studied the common branches to some extent, but principally arithmetic. When I went to the city to pass examinations for entrance to the normal school my examination in arithmetic was pronounced excellent, while I could scarcely pass the examinations in other studies of equal importance. After passing this excellent examination in arithmetic I had to confess that I could not measure lumber, for the simple reason that I did not know what constituted a foot of lumber, which is used as a basis to figure from: I hardly consider this practical education.

Dr. L. H. Bailey, Dean of the Agricultural College, says we need to arouse popular interest in the public schools. You institute men know best how that should be done. When you institute men have done your duty and we have a more frequent inspection of the rural schools by men qualified for that position, then the 90 per cent. of children in the common schools who never attend any other school will be a little better prepared for life work in the country when their schooldays are at an end.

Concerning the education of the farmer after he has passed school age, F. E. Dawley has this to say: "When a man reaches or passes the meridian of life the opportunity to improve his mind is often gone and he has nothing to build on but the poor foundation which he laid in youth, and, at best, in our institute work we can only put on patches or suggest improvements for the man of middle life." He also says in the same article that, "Every young man after leaving school should keep up some well-defined plan of mental culture." It was for this purpose that the institute was established.

THE BALANCED RATION.

Although the feeding of a balanced ration has been part of the teaching of the Farmers' Institute for years and may be considered "straw pretty well threshed," yet the percentage of dairy farmers who are not giving this subject any thought is very large, and instruction along this line should be a part of the work of every meeting. It seems that if in addition to the chart in common use, some blackboard work was used, performing the actual operation of working on a balanced ration, then leaving the work during the session where it could be copied, some good might result.

SOIL FERTILITY.

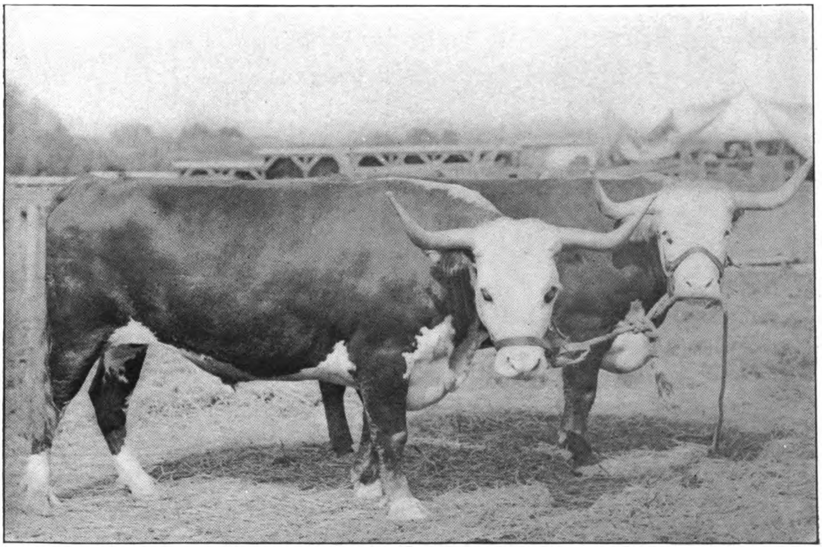
This question is undoubtedly the subject of debate at nearly all meetings and is a question that requires answering in different ways to suit different localities. It has been common for instructors at meetings in this section to tell the farmer that he should raise, on his own farm, more of the concentrated foods which he feeds to his dairy, instead of buying this product of the Western farmer, thereby keeping the money in his own pocket. This is undoubtedly good teaching, but as I travel up and down the valleys and over the hillsides in this section of Delaware county, it seems to me that the average farmer has taken this to mean larger acreage instead of better tillage. If this is true it is none too soon for the instructors to begin to teach in this and all other rough and hilly sections that one acre thoroughly tilled, properly fertilized and well seeded is worth two acres when the work is half done.

SANITARY MILK.

This furnishes a topic which will disturb the mind of the farmer and keep the institute instructors busy many years before the 35,000 dairymen who furnish milk to New York City are all educated up to the present and future demands of the city board of health. It is my opinion that no suitable and stable adjustment of this question will ever be reached except by legislative enactment, thereby establishing rules and regulations which will be State law, and after the dairymen have complied with them, they may rest assured that this law will not be changed without notice, to suit the whims or caprices of a few men in the city of New York.

Just a glance at the reports from the Forest Service would satisfy the most casual observer that it is none too soon to sound a warning to the owner of woodland and especially to the dairy farmers, who must constantly be building and repairing buildings, that in a few years at most he will be largely dependent upon his own holdings for the material to supply the needs of his business. While it may not be advisable to plant trees on any considerable amount of cleared land in this section, as our hillsides furnish the best of pasture, yet much might be done by transplanting some of the more valuable varieties of trees in the thinned places in wood lots and timber lots, made so by fires or by cutting out the less valuable varieties.

Arabian Horse.



Three-Year-Old Herefords.

FARM MACHINERY.

The selection of farm machinery is a vexing question, so much so that the Secretary of Agriculture at Washington embodied in his annual report this statement: "There is made and sold in this country $100,000,000 worth of machinery, fully one-half of which goes into the hands of men who do not know how to select wisely or to keep it in proper condition." Much of the machinery selected by these men is unsuited to the work it is intended to perform, which results in much loss to the farmer. Great loss and inconvenience are also occasioned to the users of the same kind of machinery when living in the same locality, by buying from many manufacturers instead of buying, as far as possible, machinery of the same make, thereby offering an inducement to some one to keep extra pieces for repairs, instead of having to send many hundred miles after them, and often waiting several days in the busy season for their arrival.

While the Bureau of Institutes is doing all in its power to furnish instruction along as many lines as possible, it is well to suggest at each meeting that all interested in agriculture should use to the fullest extent possible the various departments established for their benefit, using the mails freely to procure literature from the Department of Agriculture at Washington, also the College of Agriculture at Ithaca and the Experiment Station at Geneva. All should be interested in the Reading Courses, study them, fill in the correspondence sheets, write letters asking questions about anything you do not understand. This serves the twofold purpose of enlightening the writer and at the same time furnishing data to station, college and bureau as to what the farmers are most in need of or most interested in.

The Farm Partnership.

By Mrs. S. O. Smith, Busti.

Farming is a business where a partnership seems a necessity. A man would find himself badly handicapped if he tried to do the work on the farm and in the house too, and a woman finds it impossible to do the housework and superintend the work outside. The mistake that is usually made is that of each one attending to his or her part of the work exclusively; therefore, each knows nothing at all about how the partner's work is carried on. Should sickness overtake either one, or death claim one as a victim, the one left is not prepared to go on with the work, and it is a long time before the affairs are in working order. What I have to say this evening is mostly from my own observations, having spent most of my time on the farm. People living on the farm should be the happiest people in the world. The beauties of nature all around, the healthful air, the independence and freedom from the demands of society are not appreciated as they should be, as there are many farmers' wives who would gladly exchange their life of hard work and drudgery for a few rooms in the city, rather than endure the isolation and monotony of the country. Conditions are better than they were twenty-five years ago, yet there is room for improvement. One way to make things better is to arrange the farm partnership in a business-like way, that each may understand the other's work. If you talk together about the crops to be raised, what can be done to bring in a larger revenue, it will be of mutual benefit. Many times a woman will suggest things that will be helpful, though she might not be able to work them out. It won't seem such a humdrum life if you admit she has brains enough to grasp the science of farming. Study the bulletins together; those sent out from Washington, Ithaca and Geneva are interesting and helpful. Don't overlook the Reading Courses for farmers and farmers' wives; if you study them carefully you will soon realize that it needs study to run a farm, as much as any business. I believe most emphatically in equal rights and equal privileges. I do not mean that the woman shall do the work that belongs to a man by fitness nor that he shall do hers, although either may take the other's place with perfect propriety when occasion demands. I do most firmly believe that marriage will never be established upon a perfectly satisfactory and harmonious basis, until men and women deal as justly and courteously with each other as they would deal by a business partner of the same sex.

I cannot understand why "He" is always the treasurer in this partnership; he holds the pocketbook tight; all the proceeds of the farm go through his hands. If by any chance any is paid to her she must give a strict accounting of it. If she needs money for any special purpose she spends many a wakeful night and anxious day planning what plea to make. In fact, how to get it without having a — well a little conversation on the subject. She will perhaps begin as pleasantly, and, mark you, as meekly as possible. "I will have to have a little money to-day, we need a sack of flour; Johnny's shoes are worn out; and I would like a bolt of muslin for sheets." He looks so like a thunder cloud she doesn't dare go any farther, but the dear, generous man hands her, with a sigh, two dollars. "Can you make that do?" Yet he will say he never refuses her when she asks for money. Asks for it! Why should she be obliged to ask for money any more than he? These men seem to think the women are anxious to squander their hard-earned money. I feel very sure that a majority of our farmers' wives would make better use of the proceeds of the farm; make a hundred dollars go farther than the men. You say that is a rash assertion. But listen! The women for ages have had to learn how to make one dollar do the work of ten; have learned to do without luxuries and many necessities; have scrimped and turned, patched and mended until it has become second nature to them to pinch dimes into dollars. Not one cent does she spend for tobacco or beer. I would like to see the consternation on the faces of the men if they were asked for ten dollars a year to spend for candy; if they would feel sure they were booked for the poorhouse. What effect, think you, would it have on the men partners, if the tables were turned and they were obliged for six months to ask for every cent of money they had to use and tell what they wanted it for? I think the women partner would feel so mortified to see the dear husband so humiliated she would plan some sort of cash box so he could help himself. If you are at all observing you must have seen, while passing along the street or standing in a store, a man and woman talking earnestly together, neither one looking at all happy, she looking as if she would rather be whipped, he as if he would like the job. Finally, he takes out a roll of money, hands her one small bill, you don't wait to see whether her face lights up or not, or to see how pleased he is to get off so easy.

Suppose that some woman, being more audacious than most of us, should announce that she paid ten dollars for a washing machine. No doubt this is what she would hear: "Paid ten dollars for a washing machine without saying any thing to me? Here I have been saving and saving to get a gasoline engine to make my work easier. You don't seem to have any consideration for me."

We read with horror about some partner in a big enterprise taking more than his share, stealing away a little at a time, but what will the men of this audience think when I tell them I have known of farmers' wives who have put away a few eggs each day in the fall to get a little money to buy Christmas presents with. I think there are very few farmers' wives who feel they have any money of their own. Is this a fair or honest partnership?

Let me give a more pleasing picture. John says: "Well, my dear, we have got through the winter with a hundred dollars left over all expenses. No debts. What do you think of using it to buy a first-class Holstein cow?" Mary says: "I knew we had about that amount in the bank, so have been thinking we might get a new carpet for the sitting-room. We have been needing a new one for a long time, but I couldn't see how we could spare the money till now." John, like most men, hadn't noticed the shabby carpet. She shows him how she has covered the worst places with rags, and moved furniture around to cover faded places. He says: "You dear, patient woman. You take fifty dollars and fix this room the best you can. A fifty-dollar cow will have to do this time." This is a fancy sketch. By this time you are thinking I am giving a one-sided view of this partnership on the farm. There is room for improvement which must come from the house partner. Many, I am sorry to say, take no interest in the business of the farm, are not aware of the great expense called for to keep fences, tools, stock, etc., in good-running order, to say nothing of the big bills for feed and fertilizer. So when there isn't any left for the new silk dress or set of furs, she feels she is cruelly treated and keeps up a continual complaining and nagging. She should feel interested enough to know why they must economize; then do her part in helping to bring about a better day. Every one will readily admit that much of the success of a farm depends on how things are managed in the house. Meals must be regular and well cooked. The hard work of the farm cannot be done unless the food is of the best.

It is the house partner's place to study these things that she may do her part intelligently. Why do so many think it extravagant to use cream, when no more healthful food can be found? If you use a cereal for breakfast you need cream to make it a balanced ration. Use milk for those who like it to drink. I really believe the city people drink more milk than most farmers' families. We can have good food and plenty of it without being extravagant. There wouldn't be so many nagging, whining women if they insisted on knowing their financial standing. Most women are willing to economize if they know the reason and necessity for it; will not want to use money needed to pay debts for unnecessary things or expensive clothing or spend money for trips that should be used to pay store bills. You say: "How can we keep sweet and good-natured when there is so much work to do?" Have you tried to find the easiest way to do your work? Are you sure there is no more time spent on some of the work than necessary? Much of the ironing can be slighted, sheets, underwear and kitchen towels. Your partner would much rather see wrinkles in the clothes than on your forehead. Are your kitchen and pantry as convenient as they can be for doing the work? If not, why not? That may be your fault; you haven't called the good man's attention to the defects and asked him to find a remedy. There's that step down from the kitchen to the woodshed or backroom which you must take so many times a day, with your hands full and your dress sure to catch in the screen door. You would much better pay a carpenter to fix this than pay doctors' bills. Pardon me for a bit from my own experience. When it was decided that we were to come to care for my parents, my mother said: "Before you begin here I want you to have that woodshed floor raised so your health won't give out as mine has, caused by going up and down that step for twenty years. Your father and others say it can't be done. I know it can." My husband looked it over and thought about it a few days, with the result that I have had a smooth path; if I die young it won't be the fault of the step.

Another complaint is that life on the farm is so isolated and monotonous. I know it is, but my dear sisters, there are many bright things to relieve this. Are you keeping up a correspondence with friends who have moved away? Then you have letters to look for and answer, keeping you in touch with other people, and things in other parts of the country. Such a wealth of books and magazines and at reasonable cost. You say you can't find a minute's time to read. You sometimes snatch a minute to read the Busti items in the paper and that is all. I haven't a particle of patience with the woman who has no time to read; it is her own fault. If you haven't a taste for reading, don't admit it, but cultivate a love for it. Make the children's dresses without tucks and ruffles rather than your mind be unadorned with the bright ideas of others. You will be a more interesting partner if you know something about the affairs of this world. If you do not aspire to some day voting and having a hand in political matters, you can know enough about politics to be an interested listener when our voters are discussing these things. It will relieve the feeling of isolation if you read the travels and descriptions of those who can visit other lands.

You ask me to tell you how to find time to read. After the breakfast dishes are washed, chickens fed and children ready for school you begin to lag a little, but, remembering that the postman will be along at half-past ten or eleven, you hurry with the sweeping, make a pie for dinner, a cake for supper. You have only a few minutes before time to get dinner, but in these few minutes, by looking at the headlines in the daily paper, you can go from Maine to California, from the Lakes to the Gulf, read of mine disasters, railroad wrecks, bank failures, murders and suicides, what the wise men in Washington are doing that they ought not to do, the ones in Albany leaving undone that they should do, and also the Busti items. You have forgotten that you were weary, but have to work fast to get dinner on the table at the stroke of twelve. How much brighter you feel, and telling the tired men the news will make the dinner hour pass pleasantly. After the dinner work is done, take a magazine and read a bright story for recreation before beginning on that stack of mending. In the evening you should always take some time to read, or have some one read aloud if you must work on that fancy work. A great amount of pleasure can be derived from reading aloud, sharing the good things with others, whether it be on farm topics or a good book. You won't have a thought of long, lonely evenings if you follow this plan.

We stay at home too closely. Get out and see your neighbors oftener. Don't wait till they are ill and need you. Organize farmers' clubs for sociability and improvement. Join the Grange. Mrs. Lord will tell you what an uplift it is to be an active member of this great organization. It is deplorable to see so many of our farmers and their wives satisfied to plod on day after day, no time to go to the meetings of the Grange, no time for recreation of any kind. Every one would be better for a half day spent every two weeks in interchange of ideas, meeting with others in the same line of business.

Let us strive diligently for better things, not satisfied unless we are improving every day.

Allow me to quote from a favorite author:

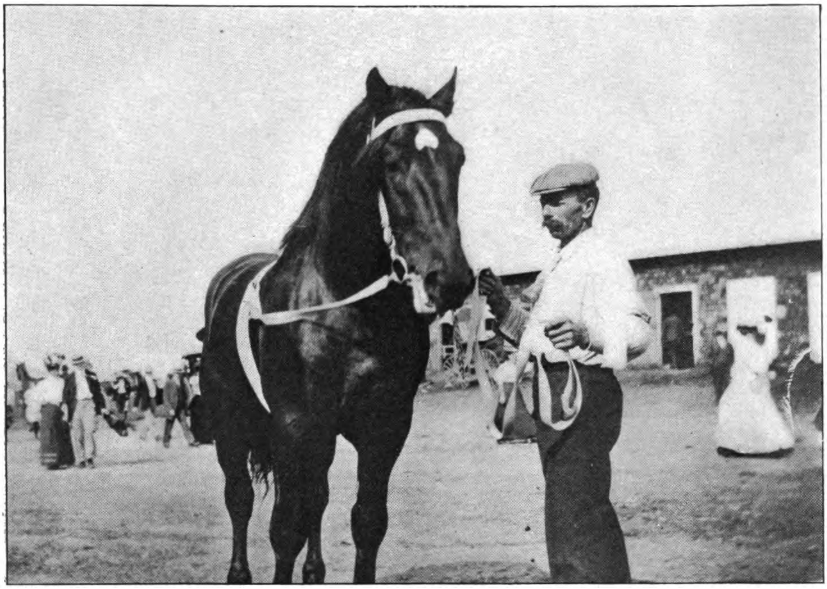
"What interest, what zest there is in life for the man who is thoroughly alive — whose faculties are all alert and active, striving for the best possible attainments! How vastly suggestive and inspiring is the untried future with its limitless outlook."

The Modern and the Model Agricultural Fair.

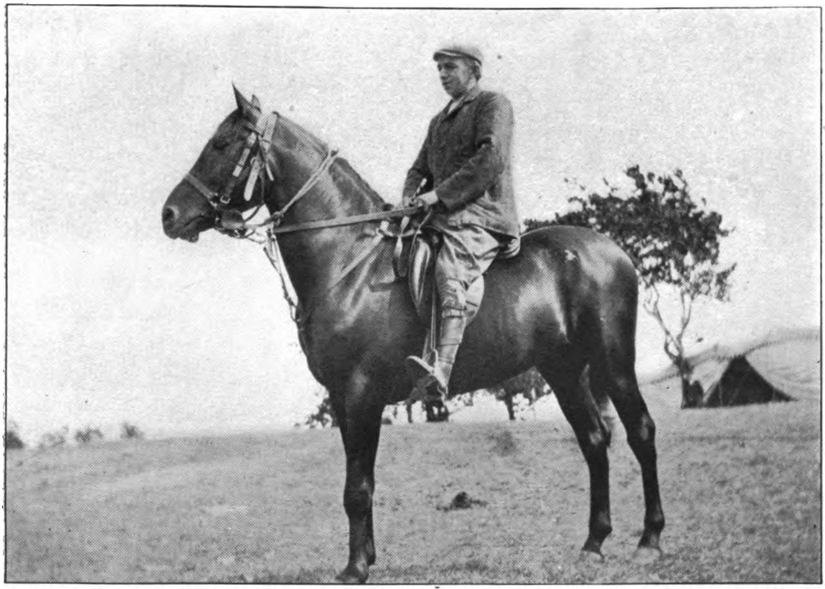
By Edward P. Mayo, Waterville, Maine.

Before telling something of what we term a model and a modern agricultural fair, I desire to pay homage to the Empire State as the birthplace of agricultural fairs, for it was here nearly one hundred years ago, or to be exact in 1810, that the idea of an agricultural fair, planned along lines similar to what we are now justly proud of, was evolved in the brain of Mr. Elkanah Watson, a retired Albany merchant, who sought rest and recreation in the Berkshire hills at Pittsfield, Mass., and took with him the great idea of an agricultural exhibition, not as a source of money making, or as an entertainer of throngs of people, but as a means of encouragement for the New England farmers, who, it goes without saying, sadly needed it. Since then there have been fairs innumerable, not only throughout this popular state, but all over the West and throughout New England. In our own Pine Tree State we have something over fifty fairs held annually, and it is no disparagement to any of them to say that they can be grouped under three heads, good, bad and indifferent, but I am pleased to be able to record the fact that the good are increasing in about the same ratio that the really bad ones are declining.

Notwithstanding this plethoric condition in our rural communities, in 1903 the people in the Kennebec valley of the Pine Tree State began to make known the fact that in their judgment Central Maine should have a fair of its own. This feeling seemed to find expression in a large number of people whose material and industrial interests center about the city of Waterville, situated equally distant from Lewiston on the south and Bangor on the north, where large State fairs had been in operation for a number of years. Waterville, being the center of a rich agricultural and stock husbandry interest, insisted that she should have a fair



German Coach Horse.



Arabian Stallion.

within her own domain, and entirely independent of the larger State exhibitions, her ambition being to outshine them in quality rather than in quantity, but, lo and behold, in a brief four years it is confidently asserted that she has outstripped them in both respects.

As has been already stated, this movement started with a little company of determined souls, who met to talk the matter over. All were of one mind, and the more ardent could hardly wait for the spring to open, that operations might commence in earnest. Almost the first thing decided upon, and that was unanimous, was that the new fair should be known as the Central Maine, and thus the child was named.

Fortunately for the project, a trolley line had just been completed connecting the city of Waterville with the railroad junction village of Oakland, and midway between the two a crude half-mile track and athletic grounds had been constructed. A contract was readily made with the trolley line promoters for the erection of large and commodious buildings of modern construction, and these were built under the supervision of the officers of the newly-formed association. Then came the matter as to what should be the limits of the fair membership.

At the very first meeting of the trustees, after a full and free discussion of the matter, it was very apparent that the child was sure to be a monster in vigor and usefulness, and the idea of curtailing its area was not to be thought of, for expansion was in the air, even at this early stage, and expansion it was, for before any one realized it the tiny, unique infant had encompassed the whole State, and we had a great State fair on our hands, reaching from Fort Kent on the north to Kittery on the south, and from the New Hampshire line on the west to the western shores of the Atlantic. It involved the people and the products of sixteen great counties, some of them larger in area than the Commonwealth of Massachusetts.

Well, after the child was fairly born, and we had decided that expansion was the thing, it dawned upon the officials that their personal responsibility had doubled and trebled many times in a very few weeks, but this only doubled our purpose and all went to work with a will. In the spring of 1904 the buildings arose as by magic, and were ready for occupancy when needed in September. (See list of illustrations page 5.)

With a fair so auspiciously inaugurated, the administration realized that the responsibility of making the exhibition worthy of its beginning was a burden little short of enormous, but with a loyal band of coworkers the work was undertaken, with no fear or doubt as to the result. The first and cardinal principle laid down was that the fair must be not only clean in every sense of the word, but progressive and up-to-date, not only a modern fair, but a model, with a full realization of the meaning of both words. This declaration at the start met with a hearty shout of approval from all the friends of the youngster. Do not think for a moment that it was all sunshine, not by any manner of means. There never was any undertaking worthy of great effort without its doubting Thomases who did not believe that the community was quite ready for such methods.

The inauguration of this fair was no exception to the rule, for there were not a few people who feared that we were getting a little too finicky to make so much ado about a "clean fair," when no one had said anything about any other kind. This opposition, however, only fixed our determination to go ahead despite all opposition and be the first in the field, with an absolutely clean, healthy, progressive agricultural fair, with strong educational features. We declared that we would not drive any one away on account of our cleanliness, neither would we allow any one to drive us away on account of their vulgarity, for that was really what we were up against. While we would not drive any one away, we would show them a better way than they had ever known. We said we did not believe it was necessary to encourage or cater to the patronage of certain classes who had done much in the past to pull down and degrade other fairs. If they came to us they would come under our conditions, not under theirs.

One single instance taken from life will illustrate this point, I think, very clearly, and will also make clear the devious ways that designing men take to pollute a well-meaning agricultural fair. A few weeks before the gates were opened for the first exhibition, the president of the association was approached more than once by several prominent citizens of the town, who asked him if a certain party, whom we will designate as John Jones, had made a business proposition to him. The reply was that nothing of the sort had been suggested by Jones, when the retort would come, "Well, he has some sort of a proposition to make to you, and Jones is a good fellow and I hope you will listen to it, for, as you well know, everything that Jone's touches succeeds, and everything that he opposes falls to the ground, so we surely want Jones with us in this undertaking." After similar conversation had been had with several well-to-do citizens, Jones approached the president and in his usual blunt, straightforward manner said that there was ten dollars profit on a keg of beer, that on a hot day they could run off a hundred kegs, and he was willing to divide that profit either with the president or with the society. If he could have the privilege of being sole dealer, they could locate him anywhere on the grounds, put a police officer in front of the stand and a cash register on the counter, and he would divide the profits every night.

I have to admit that the proposition was so startling that I had to beg a little time to think it over. I told him that I would take it under advisement, and if we concluded to accept the proposition we would write him. That was four years ago, and the president has been so busy with his many duties that he has not had time to write to Jones yet. But it was not necessary, for Jones was a quick-witted fellow, and he saw at once that the bait was not at all alluring, and the word went out forthwith that the Central Maine was to be clean in word and in deed.

It was all very easy and nothing as hard as some may think. We went right to the very best element of the community for counsel and advice. We appealed to the pastors and their wives, to the teachers and to their pupils, and said we wanted their help, counsel and advice in making this truly a modern and a model agricultural fair, right in the garden spot of Maine. It is not necessary for me to tell you that the loyal and royal responses that we received rolled in on us like a flood, and at the annual meeting that followed our first exhibition, the wife of the pastor of one of the largest churches in the city arose and very eloquently and feelingly thanked the officers of the association for establishing a fair that the mothers and the children could attend and visit in every part, without seeing or hearing anything whatsoever that might offend the most fastidious.

On a Governors' Day we entertained three live governors from three live States in the Union, and they, one and all, declared that such sight and scenes could not be witnessed on any fair grounds in their States without some disturbing elements interfering with the complete enjoyment of the vast throngs. They saw our grounds brilliantly lighted by electricity and thronged with people until ten o'clock at night, but without the slightest accident or loud or insulting remark from any of the vast company of fakirs gathered from the four quarters of the globe, and what was true of the fakirs' domain was especially true in the quarter stretch in front of the grand stand during the height of the racing.

Right here let me say a word for the fakirs. I am aware that in some of the more modern fairs fakirs are eliminated entirely, but I am clearly of the opinion that this is decidedly a mistake. It may do well enough where there is only an agricultural element, but where the crowds are made up of industrial classes they get much pleasure and no little amusement from fakirs' row, and under proper supervision there is no possible objection to the better class of so-called fakirs at an agricultural fair.

We are not satisfied with having a clean, progressive and aggressive fair, but we have a unique fair as well, and I am sure you will believe this when I tell you that we dispense entirely with the old threadbare vaudeville show in front of the grand stand. To my mind we have something far superior, which entertains the people far more. Recognizing the fact that some sort of entertainment is very desirable between the heats, notwithstanding the fact that we have three races on the card at once with very little intermission between heats and absolutely no waits, we plan to have fancy hitches, the biggest and best heavy horses to be found in the land, even bringing them from the Far West for that purpose, also pony hitches, both great and small, intermingled with bareback and standing running races, trained horses, etc. We often have from thirty to forty distinct acts on the track each afternoon, in addition to the three regular races. From this

I think you will understand that there are no idle moments, and not five minutes but what something worth looking at is going on. Long waits are a nuisance anywhere, but nowhere are they so unbearable as at an otherwise up-to-date fair.

But do not think that our fair is made up solely of the midway and the race track sports. We have a great cattle department. We have upward of six hundred head of fine neat stock, and, in passing, let me say that the cattle department is distinct from the horses and the horses from the agricultural, industrial and fancy exhibit, so that one who visits our grounds can go directly to the department he is most interested in, without being annoyed with sights and scenes that interest him not a whit. In arranging our stock exhibit, we naturally decided that this should be clean, too, so we furnished a plentiful supply of clear running water, and instructed the superintendent to see to it that no stock that was neglected in this respect should see the inside of the judge's ring. This rule brought the objectors to the front once again, and they protested that we were getting altogether "*too too,*" and cited the fact that the largest fair in Massachusetts allowed the stock to come into the ring reeking with filth, and as far removed from grooming as the steers on the ranches in the West. But we stood firm, and, of course, had the judges with us. We insisted that only clean animals would be judged for premiums at a fair whose cardinal principle was cleanliness. In order to make it a little more palatable for the owners to keep their stock "*spicty spandy,*" we insisted that the owners of the stock, or a representative at least, should be with them all through the day, to give all required information concerning them to visitors. This had the desired effect. The owner of stock that was uncleanly did not care to exhibit them to visitors, but as the visitors were bound to come there was nothing to do but clean up the stock, and the result was most gratifying, for absolute cleanliness of stock on exhibition goes a great way in augmenting the pleasure of visitors, especially the class whose admiration exhibitors appreciate most.

The first year we had a good exhibit of poultry, and the wise ones told us that we would have to make a specialty in some other direction, as we could not duplicate that poultry show again, but we not only duplicated it but more than doubled it the second year, and have easily beaten our record each year. The cages are new, uniform in appearance, and arranged in a very attractive manner, and the poultry exhibit is one of the crowded places on the grounds from early morn until late at night.

In my admiration for the live stock exhibit I very nearly forgot the part that the ladies have in the exhibition, the Arts and Crafts exhibit. We have a building nearly two hundred feet long, by one hundred feet wide, which is crowded to overflowing, from the opening of the gates until the closing of the same. There is a stage at one end of the immense auditorium, where an orchestra discoürses music, a baby show with one hundred plump, fat, laughing babies, while the closing day is devoted to the entertainment of the old people, all who are seventy-five years old or older being admitted free on that day. It is surprising to see the number of pleasing, entertaining and instructive acts that can be easily obtained for the stage show, and it adds very much to the enjoyment of the visitors.

Among the so-called Puritanical rules established for the maintenance and care of the grounds was one closing the race track and the athletic grounds on the Sabbath. Of course, the precedent established on other tracks was quoted freely, and we were told flatly that it could not be done, but a couple of signboards six inches wide and a foot long, posted in conspicuous places at the entrance to the track, on a certain Saturday morning, did the trick very handily, and for four years there has not been a wheel turned on the race track on the Sabbath day. I venture to say that not even a horseman would like to have the old condition of things re-established, for there is no class of men which so richly deserves a day of rest as the grooms and caretakers at a race track.

Our grounds are kept open and a very convenient drive is furnished through the cattle department, and by the horse stables, out on the opposite side, and much driving is indulged in there on Sunday. As the grounds are kept picked up and the flowerbeds trim and thrifty, while the buildings are looked after in a very exacting manner, it makes a very attractive and popular drive on Sundays as well as on week days, but the race track and athletic grounds are unused on those days.

I can see and almost hear some one asking what became of Jones and his fellow sympathizers who were turned down so ruthlessly at the beginning of this fair. Why, bless your souls, they clamored to get on to the band wagon, when they found which way that vehicle was moving, and they have worked right heartily with us in all our efforts to make the fair the success it has been. It is a great mistake to suppose for a moment that you will have to cater to this class or they will try to injure you. The exact opposite is the fact, for the moment they find that you are resolute and determined in your course, they clamor to be the first ones in the procession, and you cannot drive them away. Remember that you must steer the ship and determine the policy of your fair, and then stick to it through thick and thin, or you can have neither a modern or a model agricultural fair.

I should fail entirely of my purpose were I to omit from this already too long narrative an account of our annual gathering to elect officers, receive reports of the officers, pay the premiums and have a good time generally. This occasion comes the Saturday of Thanksgiving week, and is held in the large Coliseum, the dinner being served in one end of the immense building, while literary exercises are arranged in the other end. After the routine business of the association is concluded there is a feast of reason and flow of soul, prominent speakers being provided to discuss the various phases of agricultural fairs, farm work and life generally. The exhibitors also have their innings, and are not slow to suggest to the management any improvements that occur to them, either in the management of the judging, the exhibit generally, the care of the grounds, etc., the discussion on this line often taking a wide range. A recess is taken at noon for a farmer's dinner, served right in the building at a nominal expense. After dinner the speaking is resumed, often interspersed with music, stories, poems and what not.

In the meantime, the treasurer and his assistants in an anteroom are busy passing out checks for the several premiums. I am speaking clearly within bounds when I tell you that the annual meeting with the speechmaking, the dinner and the good cheer that goes with all these things is one of the potent factors that makes the Central Maine fair very nearly a modern and a model institution.

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